# SELECTED WATER RESOURCES ABSTRACTS

VOLUME 3, NUMBER 4
FEBRUARY 15, 1970

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**Selected Water Resources Abstracts** is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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# SELECTED
# WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

**VOLUME 3, NUMBER 4**
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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

# FOREWORD

**Selected Water Resources Abstracts,** a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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ABSTRACT SOURCES

# SELECTED WATER RESOURCES ABSTRACTS

## 01. NATURE OF WATER

### 1A. Properties

**THERMAL NEUTRON SCATTERING MEASUREMENTS IN WATER,**
Gulf General Atomic, Inc., San Diego, Calif.
G. M. Borgonovi, J. U. Koppel, and J. A. Young.
Office Saline Water Res and Develop Progr Rep No 449, May 1969. 59 p, 20 fig, 45 ref. Available from the Superintendent of Documents, U S Gov't Printing Office, Washington D C, 20402, for $0.65 per copy. OSW Contract No 14-01-0001-1705.

Descriptors: *Water properties, *Analytical techniques, *Neutron absorption, Ice, Water, Elastic theory, Energy transfer, Momentum equation.
Identifiers: *Neutron scattering, Thermal neutrons.

The status, quantity, and usefulness of presently available inelastic neutron scattering measurements in water have been reviewed. On the basis of this review, it has been found that good knowledge of the neutron scattering from water exists only within a limited range of the variables energy and momentum exchanges. A number of suggestions are given for the best experimental and theoretical approach for studying water by means of inelastic slow-neutron scattering. The suggestions include the analysis of the distributions of scattered neutrons instead of the scattering law for some ranges of energy and momentum transfer and the calculation of the cross section with a method that does not require unnecessary approximations. A detailed theoretical analysis of the dynamics of water has been performed for the diffusive and vibrational modes. That part of the dynamics which pertains to the rotational modes has been correlated to the slow-neutron scattering results and a best estimate for the rotational part of the frequency spectrum has been obtained. (Carstea-USGS)
W70-01296

**PROPERTIES OF WATER AND AQUEOUS SOLUTIONS AT HIGH PRESSURES AND TEMPERATURES,**
Pennsylvania State Univ., University Park.
C. Wayne Burnham, and H. L. Barnes.
Office Saline Water Res and Develop Progr Rep No 383, 1968. 52 p, 9 fig, 10 ref, 1 append. Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC. 20402 for $0.60 per copy. Grant No 14-01-0001-408 (OSW); G 19190 (NSF).

Descriptors: *Water properties, *Aqueous solutions, Pressure, Temperature, Specific weight, Equations, Volume, Argon, Statistical methods.
Identifiers: *Specific volume (Water), International Skeleton Tables.

The specific volume of water in the temperature range 20 deg - 925 deg C, at pressures up to 8,500 bars has been determined. More than 1,000 of such determinations were made in two interconnected argon-pressurized vessels, one of which was equipped with an internal heater. The raw data, in terms of specific volume as a function of pressure and temperature, were fitted throughout most of the P-T region by a ninth degree polynomial in PV as a function of T and P. The data in the low pressure-high temperature region were fitted better by an eighth degree polynomial in PV as a function of T and 1/P. The overall fit of these equations, which were used to generate tables of specific volume on orthogonal coordinates from 1,000 to 8,900 bars and from 20 deg to 900 deg C, is within 0.1% (one standard deviation). Comparisons reveal very good agreement with the work of Bridgman at high pressures and low temperatures and with the International Skeleton Tables at 1,000 bars and high temperatures. (Carstea-USGS)
W70-01299

**NONLINEAR PROBLEMS OF COMPRESSIBLE FLOW,**
Akademiya Nauk Armyanskoi SSR, Erevan. Institut Matematiki i Mekhaniki.
A. G. Bagdoev.
Jerusalem. Israel Program for Scientific Translations, 1969. 168 p, 19 fig, 1 tab, 65 ref. Clearinghouse TT 69-55023. Translation of Nekotorye Nelineinye Zadachi o Dvizhenii Szhimaemoi Zhidkosti. Erevan 1967. NASA TTF-560.

Descriptors: *Fluid mechanics, *Flow characteristics, *Waves (Water), *Compressible flow, *Mathematical studies, Flow rates, Dimensional analysis, Pressure, Sound waves, Boundaries (Surfaces), Conductivity, Viscous flow.
Identifiers: USSR, Shock wave hydrodynamics.

This monograph is an analytical study of the motion of a half-space of ideal compressible fluid stimulated by an arbitrary pressure front moving over its surface. Physically such a situation takes place in an explosion on or above the surface of a fluid. It is assumed that the pressure in the air may be considered as in the reflection of a shock wave from a rigid wall. The problem is formulated nonlinearly for the pressure, and an isentropic approximation is used. The linear theory can be greatly improved by using only the linear solution. The monograph contains discussions of the fluid pressure with a wave front moving with constant velocity over the surface, and of the pressure distribution for arbitrary conditions at the boundary of a half-space. (Gabriel-USGS)
W70-01300

**NEUTRON INELASTIC SCATTERING STUDIES OF WATER AND IONIC SOLUTIONS,**
Union Carbide Corp., Tuxedo, N.Y.
For primary bibliographic entry see Field 03A.
W70-01403

**OBSERVATIONS OF NOCTILUCENT CLOUDS.**
Vsesoyuznoe Astronomo-Geodezicheskoe Obshchestvo, Moscow (USSR).

Translation of Nablyudeniya serebristykh oblakov, Moscow, Nauka, 1967. NASA Tech Transl No 546, Apr 1969. 153 p, 29 fig, 24 tab, 257 ref.

Descriptors: *Clouds, *Cloud physics, *Water circulation, *Atmospheric physics, *Atmosphere, Ice, Winds, Temperature, Sun, Radiation, Instrumentation, Photometers, Light intensity, Altitude, Statistical methods.
Identifiers: *USSR, Noctilucent clouds.

This monograph on the observations and analytical studies of the noctilucent clouds consists of 14 articles by several USSR investigators. These articles examine the nature and the results of observations of noctilucent clouds floating at the 80-km altitude, wave movements in noctilucent clouds, methods for determining the cloud positions in a projection on the earth's surface, and calculations of the cloud coordinates using electronic computers. Some articles are devoted to linking the appearances of noctilucent clouds with atmospheric currents on the earth and with sunspot activity. (Gabriel-USGS)
W70-01416

**STRUCTURE OF 'POLYWATER',**
Pennsylvania Univ., Philadelphia. Dept. of Chemistry; and Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
Jerry Donohue.
Science, Vol 166, No 3908, p 1000-1001, Nov 21, 1969. 2 p, 2 fig.

Descriptors: *Water structure, *Water properties, *Hydrogen bonding, *Structural models, Viscosity, Density, Molecular structure, X-ray analysis, Theoretical analysis.
Identifiers: *Polywater.

A proposed structure for 'polywater' consists of hydrogen-bonded clusters of water molecules lying at the vertices of rhombic dodecahedra. In this model, all O-O bond angles can be very near to the 109 deg 28 min value observed in 8 forms of ice and in numerous hydrates. (Knapp-USGS)
W70-01443

**THERMODYNAMIC PROPERTIES OF SEA-WATER AND ITS CONCENTRATES,**
Monsanto Research Corp., Everett, Mass.
B. M. Fabuss, and A. Korosi.
Desalination 2, 271-78, 1967. 4 fig, 3 ref. Presented at 2nd European Symp Fresh Water from Sea, Vol 2, Athens, May 1967. OSW sponsored.
Identifiers: *Physical properties, *Thermodynamics, Viscosity.

Densities, vapor pressures, and viscosities of binary and ternary solutions were measured at concentrations corresponding to that of seawater and its concentrates up to a fivefold concentration over a 25 to 175 deg C temperature range. The method of investigation was to measure property values on binary solutions containing single salts, and then on ternary solutions. With correlations that were developed, the investigation was extended to multicomponent electrolyte systems. It is believed that density values of similar systems can be estimated with good reliability using this method. The superposition of an Othmer plot of the density of seawater on log-log scale vs density of water, on a plot of salt solution densities, shows that there is excellant agreement between experimental and theoretical data.
W70-01566

**SOME PHYSICAL PROPERTIES OF SEA WATER IN VARIOUS CONCENTRATIONS,**
National Engineering Laboratory, East Kilbride (Scotland).
W. H. Emerson, and D. T. Jamieson.
Desalination 3, 213-224, 1967, 6 fig, 7 ref. Presented at 2nd European Symp Fresh Water From Sea, Vol 2, Athens, May 1967.
Identifiers: *Physical properties, Experimental data, Research results, Thermal properties.

The vapor pressure of seawater and its concentrates has been measured in the temperature range 100 deg C to 180 deg C using a single isoteniscope, and the thermal conductivity has been determined in the range of zero to 75 deg C by a hot-wire comparative method. Most of the measurements were made with synthetic seawater containing no calcium sulphate, though some results obtained with natural seawater are also given. Concentrations up to five times that of natural seawater were studied. The measured values of vapor pressure have been fitted by an equation which assumes that for a given composition of salts the activity is a pure function of the total ionic strength. This yields a standard deviation as good as that obtained with measurements on distilled water and the NEL steam tables. The smoothed values of thermal conductivity are believed to be accurate to plus or minus 3%. A rise in salinity with increasing temperature is a consequence of migration of water from the liquid to the vapor phase.
W70-01568

**PROPERTIES OF SEA WATERS AND ITS CONCENTRATES UP TO 200 DEG C,**
California Univ., San Diego, La Jolla.
L. A. Bromley.
OSW R and D Progr Rept No 227, Dec 1966. 54 p, 32 fig, 10 ref.
Identifiers: *Physical properties, *Thermal properties, Thermodynamics, *Thermal capacity.

Heat capacities at one ATM pressure have been measured for seawater solutions over a concentration range of 1.1 to 11.7% salinity and a temperature range of 2 to 80 deg C. The accuracy is about 0.1%. Heat capacities as a function of temperature

are described by parabolic equations which yield values within one part per thousand of the experimental values. Near natural seawater concentration the relationship is linear. A nomograph is given from which heat capacities of sodium chloride solutions and for a synthetic seawater concentrate are compared with those of seawater solutions. Temperature coefficients of the heat capacities are also compared. The development of the design and fabrication of the pressure calorimeter are described.
W70-01572

## 1B. Aqueous Solutions and Suspensions

**HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 1. TRANSPORT BETWEEN LIQUIDS AND SPHERICAL PARTICLES IN A TANK,**
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Office Saline Water Res and Develop Progr Rep No 334, Chapter 1, p 1-24, Apr 1968. 24 p, 5 fig, 27 ref. Available from the Superintendent of Documents, US Gov't, Printing Office, Washington, DC, 20402, for $0.40 per copy. Grant No 14-01-0001-546 (OSW).

Descriptors: *Heat transfer, *Melting, Mass transfer, Convection, Ice, Correlation analysis, Statistical methods, Grivity, Density, Thermodynamics, Mixing, Turbulence.
Identifiers: *Agitated liquid, Ice spheres.

Data are reported for heat transfer from water to melting ice spheres and for mass transfer in the case of dissolving spheres of pivalic acid suspended in water agitated in a stirred vessel. The transport coefficients are found to depend on agitator power input but not on agitator design, in agreement with the Kolmogoroff theory. These experimental results are used with others in the literature to develop a correlation involving Nusselt and Prandtl or Schmidt numbers together with a dimensionless group involving agitation power. The correlation is essentially independent of solid-liquid density ratio in the range 0.8 to 1.25, and in this range the gravity group also appears to be unimportant. (Carstea-USGS)
W70-01297

**HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 2. EFFECTS OF TRANSPIRATION AND CHANGING DIAMETER TO SPHERES,**
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Office Saline Water Res and Develop Progr Rep No 334, Chapter 2, p 25-58, Apr 1968. 34 p, 12 fig, 3 tab, 15 ref. Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.40 per copy. Grant No 14-01-0001-546 (OSW).

Descriptors: *Heat transfer, *Melting, *Mass transfer, Convection, Ice, Correlation analysis, Statistical methods, Gravity, Density, Thermodynamics, Mixing, Turbulence.
Identifiers: *Agitated liquid, Viscous flow, Ice spheres.

Mass transfer to spheres suspended in an agitated liquid was studied experimentally and theoretically. Finite-difference solutions are obtained from a sphere to a fluid flowing past it in steady viscous flow. Effects of a transpiration velocity at the surface of the sphere and of a continuously changing sphere diameter are included. A normalized presentation of these effects is quite insensitive to the bulk flow Peclet number. When these theoretical corrections for transpiring and shrinking spheres are applied to the mass transfer data for ice spheres melting in an agitated brine bath, the corrected mass tranfer coefficients are brought into agreement. This aggreement suggests that the theoretical results apply with reasonable accuracy to a shrinking and transpiring sphere suspended in a turbulent liquid. (Lang-USGS)
W70-01298

**THERMOPHYSICAL PROPERTIES OF SALINE WATER,**
Monsanto Research Corp., Everett, Mass. Boston Labs.
For primary bibliographic entry see Field 03A.
W70-01402

# 02. WATER CYCLE

## 2A. General

**THE DEFINITION OF THE TERMS HYDROLOGICALLY ARID AND HUMID FOR AUSTRALIA,**
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W70-01267

**MUD FLOW STUDIES (RUSSIAN),**
Yu B. Vinogradov, V. V. Golubtsov, G. M. Beruchashvili, T. L. Kirenskoya, and Ye. D. Duseynov.
Trudy Kazakhskogo Nauchno-Issledovatel'skogo Gidrometeorologicheskogo Instituta, No 33, 1969. 167 p, 36 fig, 21 tab, 88 ref, 6 append.

Descriptors: *Mudflows, *Surveys, Streamflow, Mathematical studies, Floods, Soil stability, River basins, Mapping, Velocity, Rivers, Geology, Soil dynamics, Soil properties, Sediments, Glacial soils, Hydraulics.
Identifiers: *USSR, Mudflow hydraulics.

A collection of 16 articles by USSR investigators contains analytical and experimental studies of the mudflow phenomenon. Topics discussed include mudflow formation processes, mudflow protection engineering, mudflow hydraulics, mudflow source area geology, and glacial mudflows. (Gabriel-USGS)
W70-01276

**EVOLUTION DES VERSANTS CARTOGRAPHIE GEOMORPHOLOGIQUE DYNAMIQUE FLUVIALE: VOLUME 1, EVOLUTION DES VERSANTS (FRENCH),**
For primary bibliographic entry see Field 02J.
W70-01277

**PRESENT EVOLUTION OF SLOPES IN THE CARPATHIANS USING FIXED OBSERVATIONS AS AN EXAMPLE (FRENCH),**
For primary bibliographic entry see Field 02J.
W70-01278

**INITIAL RESULTS OF THE ANALYTIC STUDY OF SURFACE RUNOFF AND EROSION IN THE SAHARA ZONE - KOUNTKOUZOUT BASIN (NIGER) AS AN EXAMPLE (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02E.
W70-01279

**RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SECTION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),**
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
For primary bibliographic entry see Field 07A.
W70-01284

**THE ROLE OF THE EQUILIBRIUM CONCEPT IN THE INTERPRETATION OF LANDFORMS OF FLUVIAL EROSION AND DEPOSITION,**
Maryland Univ., College Park.
For primary bibliographic entry see Field 02J.
W70-01288

**APPLICATION OF STANFORD WATERSHED MODEL CONCEPTS TO PREDICT FLOOD PEAKS FOR SMALL DRAINAGE AREAS; HPR-1 (3): KYHPR-64-23,**
Lexington Dept. of Highways, Ky. Div. of Research.
For primary bibliographic entry see Field 04C.
W70-01293

**A PERTURBATION SOLUTION TO UNSTEADY UNCONFINED GROUND WATER FLOW,**
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-01407

**OBSERVATIONS OF NOCTILUCENT CLOUDS.**
Vsesoyuznoe Astronomo-Geodezicheskoe Obshchestvo, Moscow (USSR).
For primary bibliographic entry see Field 01A.
W70-01416

**RECHARGE FROM INDUCED STREAMBED INFILTRATION UNDER VARYING GROUND-WATER LEVEL CONDITIONS,**
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics; and Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 02G.
W70-01417

**SUBSURFACE IMPLICATIONS FROM SURFACE HYDROGRAPH ANALYSIS,**
Georgia Inst. of Tech., Atlanta. School of Engineering.
Willard M. Snyder.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 35-45, 1969. 11 p, 6 fig, 1 tab.

Descriptors: *Hydrograph analysis, *Rainfall-runoff relationships, *Computer models, *Computer programs, Digital computers, Data processing, Mathematical models, Hydrologic budget, Rainfall, Antecedent precipitation, Streamflow forecasting.
Identifiers: Computer watershed models.

Computer-based techniques for hydrograph analysis are useful in studying processes by which a watershed receives, stores, conveys, and releases water to form stream discharge. Computer techniques differ from conventional procedure in several respects. The total response of the streamflow to storm input is analyzed. Only flow antecedent to the storm under analysis is separated. The hydrograph is open ended. By this is meant that it is not necessary to specify a time at which flow of a certain category becomes zero. The surface hydrograph is separated into a large number of time-of-flow categories after, and based upon, the storm analysis. Every storm in a watershed record can be treated. It is not necessary to limit so-called unit hydrograph derivation to a few selected storms. The procedures described represent a complete 'package' of computer programs for processing of hydrologic records. The techniques of hydrograph analysis are treated in detail. Each step in the data processing procedures is described briefly so that the hydrograph analysis can be visualized in proper context. (Knapp-USGS)
W70-01421

**SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,**
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
C. A. Onstad, and D. G. Jamieson.

Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 46-55, 1969. 10 p, 9 fig, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Parametric hydrology, *Mathematical models, *Base flow, Computer models, Computer programs, Demonstration watersheds, Hydrologic budget, Hydrograph analysis, Data processing, Recession curves, Seepage, Groundwater movement, Runoff forecasting, Streamflow forecasting.
Identifiers: Coshocton (Ohio), Watershed models.

The relation of base flow to precipitation events was studied by hydrograph analysis using data from an ARS experimental watershed at Coshocton, Ohio. Models of base flow in watershed systems are reviewed and a new watershed simulation model is proposed. The model presented is an attempt to objectively simulate the various subsurface flow regimes. Despite the necessity of inferring the inputs to the various flow regimes, the model is realistic since it utilizes only the measured response of each flow regime. The purpose of the model is not merely to separate base flow from the total hydrograph but to simulate and later synthesize the land phase of the hydrologic system. Although it possesses thresholds which make the system nonlinear, linear reservoir theory is assumed applicable above the thresholds. The majority of parameters are inserted as measurable quantities. The system is flexible--reservoirs can be added, subtracted, or combined depending upon the response of the particular watershed. The simulation has only been demonstrated at Coshocton, Ohio, and therefore, requires further testing in differing physiographic areas. (Knapp-USGS)
W70-01424

**ENERGY DISSIPATION IN A TIDAL ESTUARY,**
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W70-01430

**STUDY OF THE RELATIONSHIP BETWEEN SURFACE AND SUBSURFACE FLOWS IN THE VIDOURLE (GARD) BASIN (FRENCH),**
Montpellier Univ. (France). Faculte des Sciences.
Claude Drogue.
Chronique d'Hydrogeologie, No 10, p 49-57, 1967. 6 fig, 6 ref.

Descriptors: *Runoff, *Subsurface flow, *Streamflow, *Karst, Aquifers, Infiltration, Hydraulic properties, Geology, Mapping, Limestones, River basins, Water sources, Discharge (Water), Hydrologic data, Gaging stations, Floods, Storm runoff.
Identifiers: *France, Vidourle (Gard) basin.

This article is a brief study of the water regime of the Vidourle River of Southern France, which passes through both karstic and non-karstic areas. The study based on hydrological and geological data shows that the greatest part of the streamflow in the upper reaches of the river is lost by infiltration into the karstic limestone rocks; however, this lost flow appears in the lower reaches. This water circulation can be explained by high infiltration coefficients and high water loss characterizing the subterranean runoffs. (Gabriel-USGS)
W70-01455

## 2B. Precipitation

**THERMAL RADIATION FROM THE ATMOSPHERE,**
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Sherwood B. Idso, and Ray D. Jackson.
Journal of Geophysical Research, Vol 74, No 23, p 5397-5403, Oct 20, 1969.

Descriptors: *Thermal radiation, *Atmosphere, *Air temperature.

A theoretical analysis of atmospheric thermal radiation was done and revealed that previous formulas relating this parameter to screen-level air temperature have lacked universal applicability. New considerations indicate that the effective emittance of the atmosphere is a minimum at 273 deg K and that it increases symmetrically to approach unity exponentially at higher and lower temperatures. A formula is developed that meets these standards and fits experimental data from Alaska, Arizona, Australia, and the Indian Ocean with a correlation coefficient of 0.992. The atmospheric radiation R, integrated over all wavelengths, is specified solely in terms of the screen-level air temperature T as R= (sigma) (T to the 4th power) (1 - c exp (- d (273 -T)sq)) where c and d are constants having values of 0.261 and 0.000777, respectively. It appears that the formula may be valid at all latitudes and seasons. (Guerrero-Vanderbilt)
W70-01386

**EDDY DIFFUSION COEFFICIENTS DUE TO INSTABILITIES IN INTERNAL GRAVITY WAVES,**
Southwest Center for Advanced Studies, Dallas, Tex.
R. R. Hodges, Jr.
Journal of Geophysical Research, Space Physics, Vol 74, No 16, p 4087-4090, Aug 1, 1969. 11 ref, 1 fig.

Descriptors: *Diffusion, *Turbulence, *Atmosphere, Heat transfer.
Identifiers: *Internal gravity waves, *Eddy diffusion coefficient, Mesosphere, Thermosphere.

The purpose of this study was to elucidate the role that internal gravity waves play in the generation of turbulence in the mesosphere and lower thermosphere. Internal gravity waves in the upper atmosphere tend to grow in amplitude with increasing height to maintain continuous vertical transport of wave energy. The growth of amplitude of a wave is limited by convective instabilities that must form at the height where the temperature oscillation becomes great enough to include a superadiabatic region. This turbulence attenuates the wave by eddy transport of heat and viscous stress through the wave structure, essentially maintaining a constant amplitude of the wave at greater altitudes. An eddy diffusion coefficient of the order of 10 to the 7th power cm sq/ sec is sufficient to explain the thermal structure of the mesopause region. Sporadic turbulence produced by instabilities in gravity waves is probably an important process of the upper atmosphere. Conclusions were (a) Internal gravity waves are an important source of turbulence in the upper atmosphere. (b) Wave-induced turbulence is the dominant cause of eddy transport throughout the mesosphere and lower thermosphere. (Guerrero-Vanderbilt)
W70-01388

**METEOROLOGICAL APPLICATIONS OF REFLECTED RADIANCE MEASUREMENTS FROM ATS 1 AND ATS 3,**
Wisconsin Univ., Madison. Space Science and Engineering Center.
For primary bibliographic entry see Field 07B.
W70-01436

**CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION IN SOME REGIONS OF THE USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-01448

**SELECTED BIBLIOGRAPHY ON THE CLIMATE OF THE CENTRAL AMERICAN COUNTRIES,**
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 10.
W70-01476

**THE SNOW COVER OF THE ANTARCTIC AND ITS ROLE IN THE PRESENT-DAY GLACIATION OF THE CONTINENT,**
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 02C.
W70-01477

## 2C. Snow, Ice, and Frost

**TILL FABRIC ANALYSES FROM THE LOTHIANS, CENTRAL SCOTLAND,**
Edinburgh Univ. (Scotland). Dept. of Geography.
R. P. Kirby.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 48-60, 1969. 13 p, 8 fig, 1 tab, 37 ref.

Descriptors: *Till, *Petrofabrics, *Analytical techniques, *Pleistocene epoch, Glaciers, Mapping, Geology, Topography, Glacial drift, Altitude, Data collections, Data processing, Statistical methods, River basins.
Identifiers: *Central Scotland, Lothian till.

The results of 64 till fabric analyses taken from three superposed tills of Central Scotland are described in detail. Highland ice moved across the Lothians from W to E. Over some parts of the district, the basal till is covered by the intermediate till whose regional fabric pattern indicates Southern Uplands ice-movement from SW to NE. The uppermost layers of till, the Roslin till, however represent a minor readvance from the north. (Gabriel-USGS)
W70-01254

**STUDIES OF THE INTERNAL DRAINAGE OF GLACIERS,**
Uppsala Univ. (Sweden). Dept. of Physical Geography.
Thorsten Stenborg.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 13-41, 1969. 29 p, 16 fig, 46 ref.

Descriptors: *Glaciers, *Drainage systems, *Drainage patterns (Geologic), *Tracers, Tracking techniques, Fissures (Geology), Streamflow, Model studies, Topography, Geomorphology, Mapping, Snowmelt, Seismic studies, Hydrologic properties, Ablation, Permafrost.
Identifiers: *Sweden, Mikka and Stor glaciers.

Internal drainage of Mikkaglaciaren and Storglaciaren of Northern Sweden was investigated on the basis of salt injections and seismic and hydrogeological data. The internal drainage of Mikka glacier consists of two separate systems corresponding on the surface of the glacier to areas of fissures characterized by different strike directions. A drainage model devised for Mikka glacier is assumed to be applicable to the drainage of Stor glacier. (Gabriel-USGS)
W70-01255

**A TYPE OF CIRCULAR LAKES IN NORTHERNMOST NORWAY,**
Lund Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02H.
W70-01256

**WATER SUPPLY IN COLD REGIONS,**
Army Terrestrial Sciences Center, Hanover, N.H.
Amos J. Alter.
Available from Clearinghouse as AD 685 850, for $3.00 in paper copy, $0.65 in microfiche. Cold Reg Sci and Eng Monogr 3, Sec C5a, Jan 1969. 85 p, 62 fig, 8 tab, 228 ref, 1 append. DA Proj 1T062112A130.

Descriptors: *Water supply, *Waste disposal, *Sanitary engineering, *Cold regions, Water treatment, Sewage treatment, Cold weather construction, Permafrost, Tundra.
Identifiers: Cold region sanitary engineering.

The principles involved in cold-region sanitary engineering are not materially different from those of sanitary engineering in temperate climates, but application of these principles is different. Heat conservation, humidity, light, construction and operation costs, and the efficient use of materials and resources are more important in cold regions; biological and chemical reactions are generally retarded at low temperature; and materials and their physical characteristics must be evaluated under cold-region conditions. Thermal analysis of all materials, systems and processes must be included as a part of the design; neglect of this may result in project failure. Availability and use of heat energy are highly important in sanitary engineering systems in cold regions. Water and fuel oil may be comparable in value, and new limits are imposed on design. Unavailability of aggregates, timber and many other common building materials from local sources limits construction. Among the approaches to solving the cold regions water system problems have been (1) encapsulation of the water system, (2) warming of the whole environment, and (3) substitution of a 'bucket brigade' consept for a proper community distribution system. A cold-region community spread over a large area cannot be effectively supplied with water from a conventional central system with long distribution lines. (Knapp-USGS)
W70-01259

**WATER TEMPERATURES IN A SHALLOW LAKE DURING ICE FORMATION, GROWTH AND DECAY,**
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02H.
W70-01393

**PILOT STUDY OF ICE DRIFT IN THE GULF OF ST. LAWRENCE,**
Massachusetts Inst. of Tech., Cambridge; McGill Univ., Montreal (Quebec). Marine Sciences Centre; and McGill Univ., Montreal (Quebec). Dept. of Physics.
R. G. Ingram, O. M. Johannessen, and E. R. Pounder.
J Geophys Res, Vol 74, No 23, p 5453-5459, Oct 20, 1969. 7 p, 3 fig, 1 tab, 7 ref.

Descriptors: *Ice, *Drifting (Aquatic), *St. Lawrence River, *Remote sensing, *Instrumentation, Buoys, Wind pressure, Theoretical analysis, Mathematical studies, Currents (Water), Air Meteorology, Seasonal, Latitudinal studies, Tidal effects.
Identifiers: Gulf of St. Lawrence, Ice drift.

A pilot study of ice drift has been made in the Gulf of St. Lawrence. A toroidal buoy with a radio beacon that was set out March 1, 1967, on an ice floe off the Gaspe coast drifted toward the southeast. Seven position determinations were made by the Ice Reconnaissance Aircraft, Meteorological Branch, up to March 20, when the beacon stopped transmitting. The buoy was recovered on May 7 south of the Magdalen Islands. By means of the Reed and Campbell theory, the ice drift due to the wind stress is calculated and the difference between the theoretical drift and the observed drift is assumed to result from surface current. The area between Anticosti Island and the Gaspe coast shows great variability with regard to its surface circulation, as during ice-free months. Furthermore, the analysis indicates that the internal ice stress, which is neglected in the Reed and Campbell theory, should be taken into account in future models. Hourly values of the ice drift velocity indicate that the ice floe is affected by the tidal current. (Gabriel-USGS)
W70-01446

**THE SNOW COVER OF THE ANTARCTIC AND ITS ROLE IN THE PRESENT-DAY GLACIATION OF THE CONTINENT,**
Akademiya Nauk SSSR, Moscow. Institut Geografii.
V. M. Kotlyakov.
Isreal Program for Scientific Translations, Jerusalem. 1966. Transl from Izdatel'stvo Akad Nauk SSSR, Moscow, 1961. 256 p, 75 fig, 33 tab, 413 ref. Clearinghouse TT 65-50144.

Descriptors: *Snow cover, *Antarctic, *Glaciation, Climatology, Meteorology, Snow surveys, Ice, Sublimation, Research and development, Winds, Temperature, Glaciers, Firn.
Identifiers: *Antarctic snow cover, Katabatic winds, Antarctic ice sheet, Snow-firn layer.

Investigations of the Antarctic snow cover by the USSR in the International Geophysical Year include: (1) climatic and meteorological factors determining the formation of the snow cover; (2) formation of the snow cover; (3) development of the snow-firn cover; (4) some properties of Antarctic snow; (5) peculiarities of the snow cover in different regions of the continent; and (6) evolution and development tendencies of the Antarctic ice sheet. There are 413 references cited in the text. The main characteristics of the formation and development of the Antarctic snow cover have been clarified as a result of half a century of investigation. The formation and development of the snow cover as large ice sheets are determined by the katabatic winds which exist everywhere. The basic processes of ice and firn formation in the Antarctic ice sheet are recrystallization by sublimation and subsidence. The intensity of these processes is primarily a function of temperature of the snow firn layer. Many glaciological problems are solved by studies of the snow-firn cover on glaciers. (Carstea-USGS)
W70-01477

## 2D. Evaporation and Transpiration

**A NOTE ON THE EVAPOTRANSPIRATION FROM A PADDY FIELD,**
Kochi Univ. (Japan).
Tokuro Seo, and Nobuyuki Yamaguchi.
Berichte des Ohara Inst fur Landwirtschaftliche Biol, Okayama Univ, Band 14, Heft 3, p 133-143, Nov 1968. 11 p, 3 fig, 2 tab, 10 ref, 2 append.

Descriptors: *Evapotranspiration, *Crops, Micrometeorology, Seasonal, Microenvironment, Heat balance, Dynamics, Land use, Rice, Irrigation water, Plants, Mathematical studies, Soil temperature, Radiation, Winds, Altitude, Roughness coefficient, Water loss, Moisture content.
Identifiers: *Japan, Kurashiki, Rice paddies.

Evapotranspiration from a paddy field at Kurashiki, Japan was analyzed for several days during the period July to October 1963 by using heat balance and aerodynamic methods. Using the heat balance method, determination of the net radiation is reliable to 5 to 10% and evaluation of thermal exchange is rather difficult. The aerodynamic method is based on determination of moisture gradients and wind speed gradients. In general, the heat balance method, although it is less satisfactory theoretically since it includes non-meteorological parameters, can be considered as more suitable for evapotranspiration studies of rice fields. (Gabriel-USGS)
W70-01287

## 2E. Streamflow and Runoff

**BRAHMAPUTRA RIVER: CHANNEL PROCESSES AND SEDIMENTATION,**
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W70-01242

**ON THE GEOMETRY OF CURRENT RIPPLES IN RELATION TO STABILITY OF FLUID FLOW,**
Reading Univ. (England). Sedimentology Research Lab.
J. R. L. Allen.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 61-96, 1969. 36 p, 36 fig, 8 tab, 84 ref.

Descriptors: *Ripple marks, *Analytical techniques, *Currents (Water), *Streamflow, Friction, Topography, Model studies, Geology, Sands, Wavelengths, Waves (Water), Mathematical studies, Correlation analysis, Fluid mechanics, Fluid friction, Froude number, Vortices, Hydraulic models.
Identifiers: *Current-ripple geometry, Fluid flow stability.

The relation of geometry of small-scale current ripples to the evolved flow over the bed was investigated analytically and experimentally by assuming fluid stability. Wave-like changes of current-ripple elevations are associated with adjustment of the streambed to three-dimensional fluid motion and are characterized by corkscrew vortices similar to the Taylor-Gorter vortex type. Experiments made with beds of a fine-grained quartz sand reveal that the characteristic wavelength of features due to vortices diminishes with increasing relative roughness and Froude number. An empirical equation connecting the mean wavelengths of spanwise and streamwise features of a rippled bed, with the relative roughness and Froude number, appears to be applicable to the study of much larger dunes formed in water. Wavelength ratios for these dunes overlap in value with ratios measured from subaqueous bed forms. (Gabriel-USGS)
W70-01243

**WATER SUPPLIES FOR COULEE DAM NATIONAL RECREATION AREA, WASHINGTON,**
Geological Survey, Tacoma, Wash.
Henry W. Anderson, Jr.
Geol Surv Open-file Rep, 1969. 104 p, 32 fig, 16 tab, 16 ref.

Descriptors: *Water resources, *Water demand, *Recreation, Facilities, *Washington, *Grand Coulee Dam, Groundwater, Aquifers, Water wells, Water quality, Water yield, Glacial drift, Streamflow.
Identifiers: Coulee Dam National Recreation Area.

A general evaluation was made of the overall water resources of the Coulee Dam recreation area, Washington and potential water supplies were located and described in detail at several campgrounds where expansion of facilities is anticipated. Although surface water is available from streams at several campgrounds and from Franklin D. Roosevelt Lake, the treatment required of surface-water supplies makes groundwater a preferred source. Most groundwater in Coulee Dam National Recreation Area is available from unconsolidated deposits that formed glacial-lake deltas and glacial outwash in Pleistocene time. Groundwater may possibly be available from the bedrock which includes basalt of the Columbia River Group of Miocene-Pliocene age in the southern part of the area, and the northern part of the area. The project included an evaluation of the water-supply potential at 35 campgrounds and picnic areas. Groundwater supplies were obtained by production wells drilled at 4 sites. Groundwater could be obtained at each of 8 other campgrounds where a detailed study was made, and supplies could be obtained at most of the other 23 campgrounds in the project area. The chemical quality of groundwater in most of the area is good. (Knapp-USGS)
W70-01244

**COMBINED USE OF SURFACE AND GROUND WATER FOR THE WATER SUPPLY TO BARCELONA (SPAIN),**
For primary bibliographic entry see Field 04B.
W70-01248

**FLOOD PLAIN INFORMATION, GLACIER CREEK, GIRDWOOD, ALASKA.**
Army Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 04A.
W70-01249

**TEMPERATURE OF SURFACE WATERS IN MONTANA,**
Geological Survey, Helena, Mont.
For primary bibliographic entry see Field 07C.
W70-01250

**FLOOD PLAIN INFORMATION, KAAAWA, OAHU, HAWAII.**
Corps of Engineers, Honolulu, Hawaii.
For primary bibliographic entry see Field 04A.
W70-01251

**FLOOD PLAIN INFORMATION, MORGANTON, NORTH CAROLINA: VOLUME 1. HUNTING CREEK AND TRIBUTARIES.**
Corps of Engineers, Charleston, S.C.
For primary bibliographic entry see Field 04A.
W70-01252

**INITIAL RESULTS OF THE ANALYTIC STUDY OF SURFACE RUNOFF AND EROSION IN THE SAHARA ZONE - KOUNTKOUZOUT BASIN (NIGER) AS AN EXAMPLE (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
G. Vuillaume.
Cahiers ORSTOM, Ser Hydrol, Vol 5, No 2, p 33-56, 1968. 5 fig, 2 tab, 5 ref.

Descriptors: *Surface runoff, *Erosion, *River basins, Agriculture, Economics, Population, Storms, Geology, Tertiary period, Vegetation, Humus, Soils, Gaging stations, Discharge measurement, Suspended load, Sedimentation, Floods, Pit recharge.
Identifiers: *Niger Basin.

Hydrological and erosional data were recorded in the Kountkouzout (Niger) Basin for the purpose of protecting agricultural land from floods and soil erosion. The verification of water discharge, erosion measurement techniques, results of solid transport, and erosion balance are discussed. The results of the study are given in numerous tables and figures showing the values of runoff, erosion, saturation, precipitation, solid load transport, and suspension recorded during the dry and wet seasons of 1965, 1966 and 1967. (Gabriel-USGS)
W70-01279

**ON THE PENETRATION OF A TURBULENT LAYER INTO STRATIFIED FLUID,**
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
For primary bibliographic entry see Field 08B.
W70-01383

**JET DIFFUSION IN THE REGION OF FLOW ESTABLISHMENT,**
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 08B.
W70-01387

**AN EXPERIMENTAL STUDY OF TURBULENCE IN A DENSITY-STRATIFIED SHEAR FLOW,**
Manchester Univ. (England). Dept. of the Mechanics of Fluids.
For primary bibliographic entry see Field 08B.
W70-01389

**TIME-OF-TRAVEL STUDY - MOHAWK RIVER, ROME, NEW YORK TO COHOES, NEW YORK,**
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 05B.
W70-01404

**RIP CURRENTS: 1. THEORETICAL INVESTIGATIONS,**
Liverpool Univ. (England). Tidal Inst.
Anthony J. Bowen.
J Geophys Res, Vol 74, No 23, p 5467-5478, Oct 20, 1969. 12 p, 7 fig, 25 ref.

Descriptors: *Rip currents, *Mathematical studies, *Theoretical analysis, *Vortices, Water circulation, Coasts, Waves (Water), Frequency analysis, Flow characteristics, Beaches, Shallow water, Barriers.
Identifiers: *Vorticity, Rip current formation.

The nearshore circulation of water on a plane beach produced by a wave train, normally incident on the beach, which has a longshore variation in wave height is investigated theoretically. The radiation stress arising from the excess flux of momentum due to the presence of the waves is found to provide driving terms for a steady flow pattern only inside the surf zone. A circulation pattern is thus produced by a longshore variation in the radiation stress in the surf zone. In shallow water, the radiation stress is proportional to the square of the wave height. The nearshore circulation is therefore directly related to longshore variation in breaker height, currents flowing seaward where the breaker height is low. When the inertial terms are included in the vorticity equation, an increase in the effective Reynolds number produces a narrowing, and consequently a strengthening, of the seaward flow, which suggests an explanation for the existence of the strong, narrow currents known as rip currents. (Gabriel-USGS)
W70-01431

## 2F. Groundwater

**WATER SUPPLIES FOR COULEE DAM NATIONAL RECREATION AREA, WASHINGTON,**
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02E.
W70-01244

**COMBINED USE OF SURFACE AND GROUND WATER FOR THE WATER SUPPLY TO BARCELONA (SPAIN),**
For primary bibliographic entry see Field 04B.
W70-01248

**SOLVING MULTI-WELL, RIVER GROUND WATER FLOW PROBLEMS,**
Birmingham Univ. (England). Dept. of Civil Engineering.
Robin Herbert.
J Hydrol, Vol 9, No 2, p 213-221, Oct 1969. 9 p, 8 fig, 2 tab, 5 ref.

Descriptors: *Groundwater movement, *Mathematical studies, *Model studies, *Surface-groundwater relationships, Induced infiltration, Hydraulic models, Analog models, Flow nets.
Identifiers: Hydrologic models.

A technique is described which enables three-dimensional groundwater flow between canals and multi-well systems to be reduced to two dimensions. Using the technique, two solutions are obtained to wells pumping near a partially penetrating river. The results are shown to be accurate by comparing them to full three-dimensional solutions. (Knapp-USGS)
W70-01263

**INTERFLOW OR SHALLOW PHREATIC FLOW IN THE COASTAL PLAIN OF GEORGIA,**
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center, and Georgia Agricultural Experiment Station, Athens.
For primary bibliographic entry see Field 02G.
W70-01266

**THE USE OF TRACERS TO INVESTIGATE THE RELATIONSHIP BETWEEN MINING SUBSIDENCE AND GROUNDWATER OCCURRENCE AT ABERFAN, SOUTH WALES,**
Institute of Geological Sciences, London (England). Dept. of Hydrogeology; and National Coal Board, Ystrad Mynach (Wales).
J. D. Mather, D. A. Gray, and D. G. Jenkins.
J Hydrol, Vol 9, No 2, p 136-154, Oct 1969. 19 p, 6 fig, 5 tab, 12 ref.

Descriptors: *Landslides, *Groundwater movement, *Subsidence, *Mine wastes, *Waste dump, Mine drainage, Coal mine wastes, Disasters, Tracers, Tracking techniques, Ions, Solutes, Dye releases, Permeability, Hydrogeology.
Identifiers: *Wales, *Aberfan.

Four groundwater tracing experiments, using sodium chloride and sodium fluorescein as tracers, were undertaken at Aberfan, Wales in order to investigate the influence of mining subsidence on the pattern of groundwater flow. Measurements indicated that areas subject to tensional strains were characterized by rapid groundwater movement and areas subject to compressional strains by slow or negligible groundwater movement. Boundaries between zones of tensile and compressional strains should be regarded as potential hydraulic discontinuities. Mining subsidence appeared to have contributed to the enlargement of the groundwater catchment draining the tip-complex at Aberfan. (Knapp-USGS)
W70-01268

**DETERMINATION OF WATER SATURATION HEIGHT (FRENCH),**
Strasbourg Univ. (France). Geologic Maps Service of Alsace and Lorraine.
L. Simler, and P. Ungemach.
Strasbourg Univ, Serv Carte Geol D'Alsace et Lorraine, Note de Calcul No 2, June 15, 1968. 17 p.

Descriptors: *Aquifers, *Saturation, *Saturated flow, *Permeability, *Mathematical models, Mathematical studies, Free surfaces, Runoff, Infiltration, Discharge (Water), Humidity, Air temperature, Evaporation, Diffusivity.
Identifiers: Aquifer saturation.

Water-saturation levels were analytically investigated by applying partial differential equations, the Carson-Laplace transformation formula, and Fourier Series. Somewhat similar analytical approaches were used for watertight and semipermeable basements. The vertical permeability of the basement can be evaluated provided the aquifer thicknesses and some other parameters are known. (Gabriel-USGS)
W70-01274

**BASIC RESULTS OF HYDROGEOLOGIC INVESTIGATIONS OF OIL-BEARING REGIONS OF THE NORTHWESTERN SIBERIA (RUSSIAN),**
Ministerstvo Geologii, Moscow (USSR).
O. V. Ravdonikas.
Trudy Nauchno-Issledovatel'skogo Instituta Geologii Arktiki, Vol 129, 1962. 194 p, 23 fig, 31 tab, 73 ref, append.

Descriptors: *Oil fields, *Hydrogeology, *Hydrologic properties, *Hydraulic properties, Oil reservoirs, Boreholes, Geology, Geophysics, Groundwater, Water pressure, Water temperature, Mechanical equipment, Instrumentation, Water chemistry, Natural gas, Permafrost.
Identifiers: *USSR, West Siberian oil fields, Oil field hydrogeology.

This monograph is a detailed description of analytical and field methods and techniques necessary in carrying out a reliable hydrogeological exploration for the location of natural gas and oil structures and in forecasting gas and oil possibilities. The greatest part of the monograph, however, comprises the description and the analysis of the results obtained in the northwestern part of Siberia in exploration for oil and gas reservoirs. The monograph contains the following chapters: (1) introduction; (2) investigation methods; (3) hydrogeologic characteristics of the lower reaches of the Yeninsei River; (4) a critical review of borehole data from the Ust'-Port area; (5) groundwaters; (6) conditions affecting the formation of groundwaters; and (7) oil possibilities on the basis of derived hydrogeologic concepts. (Gabriel-USGS)

W70-01275

**ON THE POSSIBILITY OF GROUNDWATER AGE DETERMINATION USING TRITIUM-HELIUM-3 METHOD (RUSSIAN),**
I. N. Tolstikhin, and I. L. Kamenskiy.
Geokhimiya, No 8, p 1027-1029, Aug 1969. 7 ref.

Descriptors: *Groundwater, *Radioactive dating, *Tritium, *Helium, Meteoric water, Rocks, Aquifers, Streamflow, Radiochemical analysis, Precipitation (Atmospheric), Atmosphere, Porosity.
Identifiers: *Groundwater age determination, Tritium-Helium method.

This brief article gives the pertinent formulas and discusses the procedure for application of Tritium-Helium method for groundwater age determination. The use of the method is based on the assumption that the isotopes of tritium and helium are conserved in the groundwater under investigation. Considerable error occurs when groundwater of relatively young age is mixed with ancient groundwater during its migration underground. In general, age determination using the tritium-helium method can be successful if the addition of radiogenic He-3 is commensurable with or exceeds the atmospheric helium content. (Gabriel-USGS)
W70-01282

**WATER-BEARING FISSURES OF THE CEVENOLE GNEISS BASED ON THE RECONNAISSANCE STUDY OF THE SAINT-JEAN-DU-GARD DAM SITE, FRANCE (FRENCH),**
Montpellier Univ. (France). Faculte des Sciences.
Par J. Avias.
La Houille Blanche, No 1, p 47-60, 1967. 5 fig, 1 tab, 6 ref.

Descriptors: *Aquifers, *Fissures (Geology), *Igneous rocks, *Damsites, Mapping, Porosity, Permeability, Water storage, Water loss, Petrography, Geology, Density, Structural geology, Drainage water, Erosion, Mathematical studies, Water circulation, Infiltration, Mechanical properties.
Identifiers: Saint-Jean-Du-Gard (France).

Water-bearing fissures of fractured gneiss were investigated using geological, hydrologic, and borehole data recorded at the Saint-Jean-Du-Gard damsite. The recorded data reveal the geometry and distribution of the fissures and altered zones of thickness varying from 35 to 40 m, with their base parallel to the topographical relief caused by Quaternary sinking. The study indicates the possibility of using drainage tunnels and galleries to increase water yield. (Gabriel-USGS)
W70-01283

**MATHEMATICAL METHOD (ABAQUE) PERMITTING RAPID EVALUATION OF AQUIFER TRANSMISSIVITIES (FRENCH),**
Montpellier Univ. (France). Faculty de Sciences.
R. Plegat.
Bull Int Ass Sci Hydrol, Vol 12, No 4, p 82-85, Dec 1967. 4 p, 1 fig, 1 tab.

Descriptors: *Groundwater movement, *Mathematical studies, *Aquifers, *Transmissivity, Discharge (Water), Theis equation, Dupuit-Forchheimer theory, Pumping, Water wells, Water storage, Water levels, Water level fluctuations, Drainage (Water), Infiltration.
Identifiers: Aquifer transmissivity evaluation, Aquifer testing.

Because recorded aquifer discharge data often permit only very sketchy transmissivity evaluations, a mathematical method is given to evaluate transmissivities. This method is based on the utilization of the Theis and Jacob formulas, using the aquifer storage coefficient, the pumping well discharge, the pumping duration, and the pumping well distance. Although this rapid method cannot replace the normal methods used for transmissivity evaluations, nevertheless, in case of the paucity of data or for obtaining rough transmissivity values, the method can give satisfactory results. (Gabriel-USGS)
W70-01290

**A PERTURBATION SOLUTION TO UNSTEADY UNCONFINED GROUND WATER FLOW,**
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
Donald Dean Adrian, and Kuang-Mei Lo.
Pap presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 22 p, 6 fig, 2 tab, 6 ref. FWPCA Grant No WP-01239-02.

Descriptors: *Unsteady flow, *Aquifers, Base flow, Mathematical models, Equations, Canals, Groundwater movement, Boundary processes.
Identifiers: *Perburbation solution, Partial differential equation, Unsteady unconfined flow.

Unsteady unconfined groundwater flow has been intractable to analytical solutions of the governing nonlinear partial differential equation. Approximation methods for linearizing the governing partial differential equation have been available in the literature; however, the resulting linearized system may not approximate closely the natural groundwater flow, especially near boundaries. The use of perturbation methods is proposed to solve the governing nonlinear partial differential equation for unsteady unconfined flow toward a canal. Finite difference methods and solutions to the linearized partial differential equation have been used to develop independent groundwater profiles to compare with those predicted by the perturbation solution. The perturbation solution appears useful in evaluating aquifer characteristics from drawdown tests. (Carstea-USGS)
W70-01407

**TRANSIENT RADIAL FLOW IN UNSATURATED SOIL,**
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W70-01408

**THE EFFECT OF SEEPAGE LOSSES ON STREAM REGIMEN,**
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 04B.
W70-01419

**STUDY OF THE RELATIONSHIP BETWEEN SURFACE AND SUBSURFACE FLOWS IN THE VIDOURLE (GARD) BASIN (FRENCH),**
Montpellier Univ. (France). Faculte des Sciences.
For primary bibliographic entry see Field 02A.
W70-01455

**DETERMINING PERENNIAL RECHARGE,**
Geological Survey, Washington, D.C.
Harold E. Thomas.
In: Groundwater Development in Arid Basins - Symposium, Utah State University, 1967, Proceedings. Utah State University, Logan, p 15-20, 1967. 6 p, 8 ref.

Descriptors: *Groundwater recharge, *Water table, *Utah, Water rights, Appropriation, Great Salt Lake, Aquifers, Irrigated land, Groundwater mining, Safe yield, Groundwater basins, Artesian wells, Seepage, Arid lands, Drawdown, Consumptive use.

The author draws from more than 30 years experience in studying several arid groundwater basins in Utah to determine recharge rates. The rate of recharge was commonly determined by using the equation: recharge equals total discharge plus or minus changes in storage. If a basin is to remain productive over the long-term, then consumptive use must be limited to 'safe yield' or average perennial recharge. Otherwise the aquifer will be 'mined' and the water table will continue to fall. Study areas discussed are Cedar City, Parowan, Escalante Valley, and the East Shore of Great Salt Lake. In the Escalante basin there is little recharge and the water level has declined since 1950, averaging less than 2 feet per year. The East Shore area shows recharge from all sources of about 70,000 acre ft/year of which about 40,000 is estimated to move westward and to be lost to evaporation or to go into the Lake. There seems to be a good case for further development. However, such additional use might lower existing artesian pressure in wells and raise a legal question of interference with existing rights. (Crouse-Arizona)
W70-01484

## 2G. Water in Soils

**FLOW AND RETENTION OF WATER IN LAYERED SOILS,**
Agricultural Research Service, Washington, D.C.
D. E. Miller.
Agr Res Serv Conserv Res Rep No 13, May 1969. 28 p, 18 fig, 12 tab, 11 ref.

Descriptors: *Soil water movement, *Water storage, *Soils, *Stratification, Permeability, Anistropy, Unsaturated flow, Field capacity, Sands, Clays, Infiltration, Particle size, Moisture content, Hydraulic conductivity.
Identifiers: Stratified soils.

Many irrigated areas are on highly stratified soils, including those with coarse layers in the profile. The water retained by a soil is affected by the characteristics of the entire wetted part of the profile. Soil overlying sand or gravel contains about 6% more water than soil not so underlain. A silt loam soil underlain by sand drains to a water content of about 40% by volume as compared to a 1/3-bar value of 27% by volume. Field water-holding capacities of fine sandy loam soils underlain by coarser materials are 50 to 60% greater than 1/3-bar values. The effect of coarse layers in the profile on soil water-holding characteristics must be understood if in such soils irrigation is to be managed properly. Research data showing the effect of coarse layers on water retention are summarized and ways of estimating water-retention properties of layered soils are discussed. (Knapp-USGS)
W70-01258

**THE CALCULATION OF NON-PARALLELISM OF GAMMA ACCESS TUBES, USING SOIL SAMPLING DATA,**
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-01262

**SOIL MOISTURE MEASUREMENT BY THE GAMMA TRANSMISSION METHOD,**
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-01265

**INTERFLOW OR SHALLOW PHREATIC FLOW IN THE COASTAL PLAIN OF GEORGIA,**
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center, and Georgia Agricultural Experiment Station, Athens.
Loris E. Asmussen, and J. C. Ritchie.
J Hydrol, Vol 9, No 2, p 182-193, Oct 1969. 12 p, 10 fig, 2 tab.

Descriptors: *Groundwater movement, *Soil water movement, Infiltration, Recharge, Aquifers, Water table, Water balance, Georgia, Coastal plains, Aquicludes, Water measurement, Nuclear moisture meters.
Identifiers: Interflow.

The shallow groundwater flow from a Tifton sandy loam soil in Georgia was evaluated by means of groundwater wells, neutron soil moisture determinations, and water discharge from a gravel-packed tile drain. The study period was from January 1, 1968, through March 31, 1968. Shallow flow accounted for 1.80 inches of the 5.70 inches of rain received during the period. A water balance for the period was determined. (Knapp-USGS)
W70-01266

**SOIL SEALING CHEMICALS AND TECHNIQUES,**
Diamond Shamrock Corp., Painesville, Ohio. T. R. Evans Research Center.
For primary bibliographic entry see Field 05E.
W70-01273

**PRACTICAL UTILIZATION OF A NEUTRON SOIL-MOISTURE METER FOR HYDROLOGIC MEASUREMENTS: INITIAL RESULTS OBTAINED FROM AN INCLINED BASIN OF TAFAINA, REPUBLIC OF MADAGASCAR (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
Pierre Pourrut.
Cahiers ORSTOM, Ser Hydrol, Vol 5, No 2, p 15-31, 1968. 12 fig, 2 tab.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, *Hydrologic properties, *Water balance, Soils, Radioisotopes, Gravels, Geology, Moisture content, Slopes, Water levels, Storm runoff, Surface runoff, Evapotranspiration, Infiltration, Velocity.
Identifiers: Neutron soil moisture meters, Madagascar.

A neutron meter was used to analyze the hydrological characteristics of soil in the Madagascar Republic during 1966-1967. The discussion includes: (1) mode of operation; (2) initial results obtained from a sloping basin of Tafaina. The necessary equipment, the evolution of a hydraulic profile, rainstorm runoff, the effect of moisture on surface runoff, the effect of evapotranspiration, soil water penetration, and infiltration velocity are described. The neutron soil moisture meter can be considered as a reliable tool for the evaluation of soil hydrologic profiles. (Gabriel-USGS)
W70-01280

**FIELD MEASUREMENT AND USE OF SOIL-WATER PROPERTIES,**
Oklahoma State Univ., Stillwater. Dept. of Agronomy; and California Univ., Davis. Dept. of Water Science and Engineering.
J. M. Davidson, L. R. Stone, D. R. Nielson, and M. E. LaRue.
Pap No H-43, presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 33 p, 16 fig, 4 tab, 15 ref.

Descriptors: *Soil water movement, *Water properties, Soil profiles, Hydraulic conductivity, Soil texture, Soil types, Drainage effects, Drainage, Hysteresis, Darcy's law.
Identifiers: *Field measurement, Silty clay, Loamy sand.

Three soil profiles were used for measuring the relationships between the hydraulic conductivity and soil-water content. The physical properties of soils varied from homogeneous to heterogeneous and the surface texture ranged from loamy sand to silty clay. No measurable hysteresis was shown from the hydraulic conductivity values which were calculated from the drainage data. The Darcy's equation and other assumptions were used to predict the rate at which water drained from each soil profile. (Carstea-USGS)
W70-01406

**TRANSIENT RADIAL FLOW IN UNSATURATED SOIL,**
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Soil Science.
Sun-Fu Shih, and George J. Kriz.
Pap No H-87 presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 18 p, 4 fig, 14 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Soil water, Pipes, Equations, Continuity equation, Gravity, Diffusivity, Mathematical studies.
Identifiers: *Transient radial flow.

A mathematical solution of a problem of unsaturated transient radial flow in a homogeneous soil surrounding a long infinitely permeable pipe that contains water flowing under pressure was developed. The equation that described the problem combined Darcy's law and the equation of continuity into an appropriate radial flow equation that included the influence of gravity. The flow was assumed symmetrical with respect to the vertical axis. It was also assumed that no flow took place beyond a certain radial distance from the pipe. Using a mean value for the soil water diffusivity, the results showed that the effect of the gravity term decreased with increasing time. (Carstea-USGS)
W70-01408

**RELATIONSHIP OF WATER QUALITY AND SOIL PROPERTIES TO SEEPAGE PROBLEMS,**
Seepage Control, Inc., Phoenix, Ariz.
J. Harlan Glenn.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 1-7, 1969. 7 p, 11 fig, 7 ref.

Descriptors: *Seepage, *Reservoir leakage, *Water quality, *Soil water movement, Expansive clays, Ion exchange, Grouting, Leakage, Linings, Permeability, Soil sealants, Surface sealing, Water loss.
Identifiers: Permeability control, Seepage control.

Actual reservoir seepage is often 5-10 times as high as predicted by laboratory tests. Usually the differences are because the contractor does not obtain the compaction of soil assumed by the laboratory and because the effect of water quality on seepage is not determined. Essentially, the permeability of clay-bearing soil is low when in equilibrium with water containing a high proportion of Na to Mg+ Ca, and high in equilibrium with water containing a low proportion of Na. Increases in total salt concentration tend to increase permeability. Treatment of soils with salts or cement can control permeability as well as swelling and cracking properties. (Knapp-USGS)
W70-01415

**RECHARGE FROM INDUCED STREAMBED INFILTRATION UNDER VARYING GROUNDWATER LEVEL CONDITIONS,**
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics; and Minnesota Univ., Minneapolis. Water Resources Research Center.
W. C. Walton.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 17-22, 1969. 6 p, 5 fig, 1 tab. OWRR Project A-014-MINN.

Descriptors: *Induced infiltration, *Surface-groundwater relationships, *Analog models, Recharge, Drawdown, Water levels, Water level fluctuations, Model studies, Analog computers, Pumping, Water wells, Water table, Glacial drift, Aquifers.
Identifiers: Miami River (Ohio).

In evaluating groundwater resources, streambeds must be simulated in mathematical and analog models in such a way that the following conditions are considered: (1) Leakage of water through a streambed is directly proportional to the drawdown beneath the streambed until the water table declines below the streambed. Thereafter, induced infiltration remains constant provided the stream stage and temperature remains stationary; (2) provided that the water table remains below the streambed, leakage of water through a streambed is directly proportional to the average depth of water in the stream and varies with stream-stage changes and changes in the temperature of the surface water. An analog study was made of the outwash aquifer in the Miami Valley, Ohio. With correct streambed simulation, an 8-well collector system resulted in simulated water level declines of over 4 ft along a 5,500 ft reach of the river, but with incorrect streambed simulation, declines exceed 4 ft along only 3,200 ft of river. (Knapp-USGS)
W70-01417

**CHANGES IN WATER QUALITY DURING SEEPAGE,**
California Univ., Davis. Dept. of Water Science and Engineering; and Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
D. R. Nielsen, and R. D. Jackson.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 8-13, 1969. 6 p, 5 fig.

Descriptors: *Leaching, *Ion exchange, *Biodegradation, Solutes, Soil water movement, Water quality, Permeability, Clays, Soils, Ion transport, Mass transfer, Tracers, Tracking techniques, Laboratory tests.
Identifiers: Water quality alteration.

Water quality is changed when the soil solution interacts with soil particle surfaces during seepage. The interaction is influenced by particle charge, mineralogy, and particle geometry. Experiments were conducted on altering the efficiency of the ion exchange process by altering seepage rates at various depths in soil profiles. The rates of movement of solutes vary considerably, so the use of single-tagged components as tracers yields relatively little information. Leaching columns are used to study decomposition of organic solutions passing through soil. (Knapp-USGS)
W70-01418

**REVIEW OF METHODS FOR MEASURING AND PREDICTING SEEPAGE,**
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer, and Robert C. Rice.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 115-120, 1969. 6 p, 1 tab, 12 ref.

Descriptors: *Seepage, *Canal seepage, *Soil water movement, Mathematical studies, Tracers, Tracking techniques, Ions, Water loss, Hydrologic budget, Water balance, Steady flow, Unsteady flow, Groundwater movement, Analog models, Computer models.
Identifiers: *Seepage forecasting.

Methods for measuring and predicting seepage from open channels are reviewed. They include the inflow-outflow, ponding, seepage meter, salt penetration, and mathematical techniques. Quantitative information of seepage losses from irrigation or natural channels can be obtained by direct measurement on the channel or by calculation. The second approach, in which seepage is calculated from the hydraulic conductivity of the soil materials and the boundary conditions of the flow system, will be of particular value for canals that are still in the planning stage, for example, in determining desired canal capacities or canal locations for minimum total seepage losses. The methodology for direct measurement or calculation of seepage from channels or reservoirs has progressed sufficiently to enable acquisition of quantitative seepage data for a wide variety of conditions. (Knapp-USGS)
W70-01420

**FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,**
Idaho Univ., Moscow. Dept. of Civil Engineering; and Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
C. E. Brockway, and R. V. Worstell.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 121-127, 1969. 7 p, 3 fig, 2 tab.

Descriptors: *Canal seepage, *Infiltration, Soil water movement, Groundwater movement, Hydrologic budget, Water balance, Flowmeters, Streamflow, Surface-groundwater relationships, Statistical methods, Irrigation.
Identifiers: *Seepage meters.

Ponding tests, seepage meters, and inflow-outflow methods of measuring seepage from canals are described and evaluated. The study was performed in 1965 and 1966 on a 4.5-mile reach of the A and B Irrigation District Main Canal near Paul, Idaho. It is 25 to 30 ft wide with a gradient of about 0.5 ft per mile and flows at a depth of 5 to 5.5 ft during the irrigation season. Soils throughout the test reach are very uniform and consist almost entirely of Portneuf silt loam. A compacted, slightly cemented silt layer from 12 to 24 inches thick intersects the canal cross section throughout most of the test reach. The flow system beneath the entire test reach is under tension gradients due to an impending layer near the soil surface of the canal cross section. Devices for recording water measurement were installed at the inlet and outlet and at all turnouts on the reach. A water budget for the irrigation season was maintained on this reach for 3 yr, and the loss rates for 2-wk periods were computed. Of the available methods for evaluating seepage losses, the ponding test is the most accurate but the most expensive. The use of seepage meters for obtaining estimates is fast and economical. Inflow-outflow methods are usually too expensive to be used for short-duration seepage measurements. (Knapp-USGS)
W70-01422

**SEEPAGE DETECTION BY REMOTE SENSING,**
HRB Singer, Inc., State College, Pa. Radiometric Lab.
For primary bibliographic entry see Field 07B.
W70-01423

**SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,**
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W70-01424

**INFLUENCE OF CAPILLARY GROUND MOISTURE ON EOLIAN ACCUMULATION OF LOESS,**
Wroclaw Univ. (Poland). Faculty of Geography.
For primary bibliographic entry see Field 02J.
W70-01440

**FORMATION AND STABILITY OF AL, FE, AND MG INTERLAYERS IN MONTMORILLONITE AND VERMICULITE,**
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 02K.
W70-01457

## 2H. Lakes

**HYDROGRAPHY OF THE BALTIC DEEP BASINS III,**
Fishery Board of Sweden.
For primary bibliographic entry see Field 02L.
W70-01245

**TEMPERATURE OF SURFACE WATERS IN MONTANA,**
Geological Survey, Helena, Mont.
For primary bibliographic entry see Field 07C.
W70-01250

**TRULLVATNET: A FLANDRIAN STRATIGRAPHICAL SITE NEAR MURCHISONFJORDEN, NORDAUSTLANDET, SPITSBERGEN,**
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
Hannu Hyvarinen.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 42-45, 1969. 4 p, 4 fig, 14 ref.

Descriptors: *Lakes, *Sediments, *Stratigraphy, *Radioactive dating, Geology, Clays, Mud, Sulfides, Mollusks, Shellfish, Radiochemical analysis, Diatoms, Lagoons, Lake basins, Sampling, Mapping, Core drilling, Shores, Structural analysis.
Identifiers: *Spitsbergen, Trullvatnet Lake.

A sediment core from Trullvatnet Lake of Murchisonfjord area was examined. The sediments of this 3 m-long core cover a period of about 7000 years, as determined by a C-14 analysis, and show a sequence of two marine-lacustrine contacts in the lower region. The core indicates the renewed connection with the sea of the basin between about 5500 and 4745 years ago. This connection was followed by a final isolation suggesting an interruption in the general trend of shoreline displacement. (Gabriel-USGS)
W70-01253

**A TYPE OF CIRCULAR LAKES IN NORTHERNMOST NORWAY,**
Lund Univ. (Sweden). Dept. of Physical Geography.
Harold Svensson.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 1-12, 1969. 12 p, 12 fig, 21 ref.

Descriptors: *Lakes, *Geomorphology, *Permafrost, Frost action, Altitude, Climates, Carbon, Radioactivity, Mapping, Geology, Cracks, Frequency analysis, Erosion, Glaciation.
Identifiers: *Northern Norway, Palsas, Pingos.

This paper discusses the palsas, pingo-like frost mounds, and circular to oval lakes having characteristics of both the palsa and the pingo groups in northeastern Scandinavia. The lakes differ from other lakes of regular shape by being enclosed by a low, uniform wall. Palsas are the most frequent permafrost features in Scandinavia. Palsas are dry low ridges, usually in bogs. The circular lakes are interpreted as a collapse stage of frost mounds originated as palsas or as pingos. Climatological and temporal factors are analyzed to explain the collapse features and fossil, low-elevation rings, present in the area. (Gabriel-USGS)
W70-01256

**WATER TEMPERATURES IN A SHALLOW LAKE DURING ICE FORMATION, GROWTH AND DECAY,**
Army Terrestrial Sciences Center, Hanover, N.H.
M. A. Bilello.
CRREL, Research Report 213, Dec 1967. 24 p, 15 fig, 34 ref.

Descriptors: *Lake ice, *Lake temperatures.

Continuous water temperature measurements were made in a shallow lake in upper Michigan prior to and during ice formation, and during ice growth and decay. Several full circulations or 'overturns' at 4 deg C were observed during autumn and the temperature throughout the lake just prior to complete freeze-over reduced to a minimum of+0.2 deg C. After a permanent ice cover had formed, the water beneath the ice began to warm up. Within a 25-day period during December the water temperature near the bottom of the lake increased from+0.3 deg C to 3.0 deg C. Quantitative analysis of this heat gain showed that it came principally from the energy stored during the summer in the underlying soils. Evaluation of the effect of solar radiation demonstrated that the sun during December contributed very little heat to the water because of the absorption qualities of the cover of snow and bubbly ice. During the ice thaw period in April a unique reduction in temperature was recorded throughout the main mass of water. Since the lake is thermally stratified, it was assumed that this cooling could only result from mechanical action in the water. This phenomenon probably takes place as the surface water from melting snow around the area flows into the lake and causes overturning. (Upadhyaya-Vanderbilt)
W70-01393

**RECORD LOW DISSOLVED OXYGEN IN THE ISLAND AREA OF LAKE ERIE,**
Ohio State Univ., Columbus. Coll. of Biological Sciences; and Ohio State Univ., Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 05C.
W70-01425

**PRIMARY PRODUCTIVITY - PHYTOPLANKTON RELATIONSHIPS, HODGSON LAKE, PORTAGE COUNTY, OHIO,**
Kent State Univ., Ohio. Dept. of Biological Sciences.
For primary bibliographic entry see Field 05C.
W70-01426

**NUTRIENT LIMITATION OF SUMMER PHYTOPLANKTON GROWTH IN CAYUGA LAKE,**
Cornell Univ., Ithaca, N.Y.
D. H. Hamilton, Jr.
Limnology and Oceanography, Vol 14, No 4, p 579-590, July 1969. 3 fig, 9 tab, 32 ref.

Descriptors: *Phytoplankton, *Limiting factors, *Nutrients, *Primary productivity, Phosphates, Silicates, Citrates, Bioassay, New York, Lakes, Inhibition, Algae, Diatoms, Eutrophication, Carbon radioisotopes, Chlorophyll, Hydrogen ion concentration, Magnesium, Calcium.
Identifiers: *Enrichment experiments, *Nutrient limitation, Cayuga Lake (NY), Asterionella formosa, Synedra, Melosira, Dinobryon, Fragilaria, Radiocarbon method, Finger Lakes (NY), Rodhe's solution VIII, Nutrient limitation, Carbon-14.

Author describes experiments performed to determine the effect of defined culture medium components on natural phytoplankton populations. Samples collected from Cayuga Lake (Ithaca, New York) at 2-3 day intervals from 20 July through 18 August were placed in an enrichment medium (Rodhe's solution VIII). Assimilation was measured with radiocarbon (C-14). Major algal culture components were Asterionella formosa and unidentified species of Synedra, Melosira, Dinobryon, and Fragilaria. Results indicated an enhancement effect with calcium nitrate, due apparently to the calcium element. Magnesium sulfate and ferric citrate-citric acid were irregularly inhibitory. Phosphate failed to stimulate cultures and ocasionally proved inhibiting. Nutrient combinations yielded variable results; author states this may be due to phenomena peculiar to the sample bottles or to changing composition and alternatively, due to physiology of the phytoplankton populations. Tabular data include results and summary of enrichment experiments. (Voightlander-Wisconsin)
W70-01579

**PHOSPHATE ADSORPTION AND ISOTOPIC EXCHANGE IN LAKE MUDS,**
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
Sigurd Olsen.
International Association of Theoretical and Applied Limnology, Proceedings, Vol 13, p 915-922, Feb 1958. 8 fig.

Descriptors: *Lakes, *Phosphates, *Adsorption, *Phosphorus radioisotopes, *Oxidation-reduction potential, Iron compounds, Cycling nutrients,

Water pollution sources, Carbonates, Sediment-water interfaces, Calcium, Oligotrophy, Eutrophication.
Identifiers: *Phosphorus fixation, *Phosphorus-32, *Phosphorus-31, *Isotopic exchange, *Lake muds, Ferrous sulfide, Chemisorption, Freundlich isotherm, Specific activity, Contact time, Denmark, Lake Fureso (Denmark), Lake Grane Langso (Denmark).

Equilibration of phosphate between water and sediment depends on many factors: temperature, redox potential, contents of iron and calcium, and the contact time. The described method, using radiophosphorus (P-32), permits simultaneous appraisal of opposing processes occurring in liquid and solid phases of the lake at welldefined oxidation-reduction levels. In the presence of oxidized sediments, the phosphate equilibrium may be expressed as the difference between its gross adsorption, following the Freundlich isotherm, and its liberation. The presence of iron in reduced sediments precludes a mathematical expression of the processes. (Wilde-Wisoncsin)
W70-01581

**LIMNOLOGICAL EFFECTS OF FERTILIZING BARE LAKE, ALASKA,**
Washington Univ., Seattle. Dept. of Zoology.
Philip R. Nelson, and W. T. Edmondson.
Fishery Bulletin of the Fish and Wildlife Service, No 102, p 415-436, 1955. 6 fig, 5 tab, 53 ref.

Descriptors: *Photosynthesis, *Limnology, *Alaska, *Fertilization, *Hydrogen ion concentration, *Eutrophication, Nutrients, Fish management, Primary productivity, Secondary productivity, Zooplankton, Phytoplankton, Oxygen, Transparency, Water pollution effects, Rotifers, Planktonic crustaceans, Salmon, Biomass.
Identifiers: *Bare Lake (Alaska), *Sodium nitrate, *Superphosphates, Ploesoma truncatum, Keratella cochlearis, Biotic relationships, Fish growth, Secchi disc transparency, Light-and-Dark bottle techniques.

Results are reported of experiment in which Bare Lake, Alaska (49 hectares; depth: mean--4.0 meters, maximum--7.5 meters) was fertilized with objective of bolstering a declining salmon fishery. Application of 2960 kilograms sodium nitrate and 1135 kilograms superphosphate (19%) annually during four successive years resulted in large increases in photosynthesis rate. Following each annual fertilizer application, phytoplankton increased manyfold and the transparency (Secchi disc) decreased from about 6 to less than 2 meters. The pH of water increased from 7.0 to 9.0. Rates of photosynthesis (dark and light bottle) were increased by factors of 2.5 to 7 in period 10 days after fertilization as compared to similar pre-fertilization interval. Egg production of rotifers apparently increased as result of augmented food supply. Failure of planktonic crustaceans to significantly increase their population size during 1950-1952 period might be attributed to their long life cycle and effectiveness of their predators. Contents of nitrates and phosphates fell to undetectable levels in a few days after application of salts. Salmon leaving the lake were longer and heavier in successive years, suggesting a response to increased food supply. (Wilde and Eichhorn-Wisconsin)
W70-01583

## 2I. Water in Plants

**ROOT SURVEY METHODS FOR HYDROLOGICAL EXPERIMENTS,**
Ministry of Works, Wellington (New Zealand); and Geological Survey, Denver, Colo.
G. J. Blake, and F. A. Branson.
J Hydrol (New Zeal), Vol 8, No 1, p 3-7, 1969. 5 p, 15 ref.

Descriptors: *Root systems, *Soil-water-plant relationships, *Reviews, Bibliographies, Surveys, Laboratory tests, Root distribution, Root development, Tracers, Water utilization, Water balance, On-site tests.
Identifiers: Root (Plant) surveys.

The roots of a plant are those parts which are normally below the surface of the soil. Root distribution is a very important factor in many hydrological studies and may be defined by the volume and/or weight of roots present, their mode of branching and diameter, their vertical distribution, and their lateral distribution in the soil profile. Evapotranspiration, infiltration, soil moisture and ground water are all affected by the presence or absence of roots. The primary functions of the root are anchorage, the absorption of water and inorganic salts in solution, the conduction of these to the stem, and the modification of moisture stresses and porosity of the soil. The root survey methods reviewed are trench profiles, monoliths, soil cores, tracer studies, soil moisture studies, and various laboratory methods. (Knapp-USGS)
W70-01439

## 2J. Erosion and Sedimentation

**BRAHMAPUTRA RIVER: CHANNEL PROCESSES AND SEDIMENTATION,**
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
James M. Coleman.
Sediment Geol, Vol 3, No 2/3, p 129-239, Aug 1969. 111 p, 48 fig, 7 tab, 58 ref. Proj No Nonr 1575 (03), Task Order No NR 388 002.

Descriptors: *Sediment transport, *Streamflow, *Bed load, *Channel morphology, Meanders, Braiding, Sediment load, Deltas, Sand waves, Sedimentary structures, Hydrologic data, Alluvial channels.
Identifiers: *Brahmaputra River, *India, *Pakistan.

The Ganges and Brahmaputra Rivers combined have formed a 23,000 sq mi delta, one of the largest in the world. These rivers originate within the Himalayan Mountains, and drain an enormous land area before entering East Pakistan. The combined rivers carry nearly 6 million cusecs of water to the Bay of Bengal. The rivers are heavily charged with sediment, transporting approximately 13 million tons of suspended sediment per day during flood. The large discharge and heavy sediment load cause the rivers to be extremely unstable, and the channels are constantly migrating laterally. The long-term patterns of river migration indicate that the Ganges has been migrating eastward, whereas the preferred migration of the Brahmaputra is westward. The Brahmaputra River displays a braided pattern in plan view, and short-term channel migration is quite drastic, with rates of movement as high as 2,600 ft a year being common. During low-river stage, trenches on the various exposed bars revealed the type of bedding formed by migration of the various bedforms. Crossbedding measurements at these stations were recorded and compared to sand body trends. The combined Bengal Basin rivers deliver some 1 billion tons of suspended sediment a year to the Bay of Bengal. Most of the sediment brought to the bay bypasses the bar and continues on into deeper water through a canyon. Thus in deep water a subaqueous delta is being formed that dwarfs the subaerial delta. (Knapp-USGS)
W70-01242

**ON THE GEOMETRY OF CURRENT RIPPLES IN RELATION TO STABILITY OF FLUID FLOW,**
Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 02E.
W70-01243

**TRULLVATNET: A FLANDRIAN STRATIGRAPHICAL SITE NEAR MURCHISONFJORDEN, NORDAUSTLANDET, SPITSBERGEN,**
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
For primary bibliographic entry see Field 02H.
W70-01253

**TILL FABRIC ANALYSES FROM THE LOTHIANS, CENTRAL SCOTLAND,**
Edinburgh Univ. (Scotland). Dept. of Geography.
For primary bibliographic entry see Field 02C.
W70-01254

**A TYPE OF CIRCULAR LAKES IN NORTHERNMOST NORWAY,**
Lund Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02H.
W70-01256

**MUD FLOW STUDIES (RUSSIAN),**
For primary bibliographic entry see Field 02A.
W70-01276

**EVOLUTION DES VERSANTS CARTOGRAPHIE GEOMORPHOLOGIQUE DYNAMIQUE FLUVIALE: VOLUME 1, EVOLUTION DES VERSANTS (FRENCH),**
P. Macar.
Evolution Des Versants, Proc Symp Int de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, Liege Univ, 1967. 384 p, 118 fig, 9 photo, 9 tab, 156 ref.

Descriptors: *Slopes, *Erosion, *Deposition (Sediments), *Geomorphology, Animals, Forests, Igneous rocks, Weathering, Climates, Mapping, Soil dynamics, River basins, Watersheds (Basins).
Identifiers: River basin slope evolution.

This volume is a collection of 23 articles on various aspects of slope evolution presented at the International Geographic Union Convention in Liege and Louvain, Belgium, on June 8-16, 1966. Six additional articles describe the pertinent information observed by the members of the Convention during their six one-day field trips. (Gabriel-USGS)
W70-01277

**PRESENT EVOLUTION OF SLOPES IN THE CARPATHIANS USING FIXED OBSERVATIONS AS AN EXAMPLE (FRENCH),**
T. Gerlach.
Evolution Des Versants, Proc Symp de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 129-138, Liege Univ, 1967. 3 fig, 2 photo, 7 ref.

Descriptors: *Geomorphology, *Slopes, *Erosion, *Mass wasting, Streamflow, Gravity, Soils, Washouts, Leaching, Creep, Ice, Freezing, Winds, Wind velocity, Vegetation effects, Forests, Infiltration, Biochemistry, Pleistocene epoch.
Identifiers: *Poland, Carpathians, Slope evolution.

The present evolution of slopes was investigated for a 4-year period using a small stream basin of 23 sq kw, located in the Polish area of the Carpathians. The rate of contemporary slope changes varies from place to place. The most important processes modifying the slopes are stream erosion and gravity mass movements, slumping in particular. Besides slumping the following processes (given in order of their importance) influence the evolution of slopes: soil washing; solution and leaching; soil creep; displacement through needle-ice; and uprooting of trees by wind action. In cultivated areas the periglacial slopes are subject to particularly rapid transformation. In areas under permanent vegetation cover (meadows and forests), soil washing, soil creep, and displacement through needle-ice are insignificant. Forested slopes and slopes covered by meadows favor water infiltration, leaching, and

biochemical processes, although all these processes do not significantly change the existing slope profiles. (Gabriel-USGS)
W70-01278

**INITIAL RESULTS OF THE ANALYTIC STUDY OF SURFACE RUNOFF AND EROSION IN THE SAHARA ZONE - KOUNTKOUZOUT BASIN (NIGER) AS AN EXAMPLE (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02E.
W70-01279

**REEVALUATING THE MEASUREMENTS OF SOLID DISCHARGES IN SUSPENSION, REPUBLIC OF CHAD (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
Bernard Billon.
Cahiers ORSTOM Ser Hydrol, Vol 5, No 2, p 3-13, 1968. 5 fig, 7 tab.

Descriptors: *Suspended load, *Suspension, *Discharge measurement, *Discharge (Water), Measurement, Hydrologic data, Laboratory equipment, Analytical techniques, Analysis, Density, Streamflow, Salinity, Chlorides, Temperature, Humidity, Lakes, Rivers, Floods.
Identifiers: Republic of Chad, Chari River, Lake Chad.

The work done by the French Office of the Scientific and Technical Researchs Overseas, in the Chad Republic is described. The discussion includes: (1) the method; (2) the causes of the errors involved in the measurements; (3) measurement scheme; and (4) the results of 4 measurements recorded on the Chari River at Fort-Lamy. The concentration of solid particles in suspension in the Chari River increases from surface to bottom with transversal variations of 30 to 50% in a distance of a few tens of meters. Mean concentrations of these suspended particles in the waters of the Chari River decrease rapidly at the end of August and then increase slowly, without being strongly affected by the abruptly rising waters of October 15. (Gabriel-USGS)
W70-01281

**A MATHEMATICAL MODEL FOR THE DESCRIPTION OF THE OPTICAL PROPERTIES OF TURBID WATER IN TERMS OF SUSPENDED PARTICLE SIZE AND CONCENTRATION,**
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Jerome Williams.
Tech Rep 47, Chesapeake Bay Inst, Johns Hopkins Univ, Ref No 68-17, Nov 1968. 16 p, 6 fig, 5 ref. Available from Clearinghouse as AD-679 168 for $3 in paper copy, 65 cents in microfiche. Proj No NR 083-016, Contract No Nonr 4010 (11).

Descriptors: *Turbidity, *Suspended load, *Mathematical models, *Estuaries, Streams, Bays, Statistical models, Mathematical studies, Optical properties, Opacity.
Identifiers: Underwater transparency, Water transparency, Suspended sediments.

A mathematical model is developed for a hypothetical suspensoid of particulate matter in water. The assumptions are that the particles are homogeneously distributed throughout the medium, the particles all are the same size, and they are all spherical in shape. The resulting expressions relate the particle radius and concentration to extinction coefficient, beam attenuance coefficient, and upwelling light. A logarithiconormal distribution is developed. It is concluded that this model does not supply enough data to determine the statistical parameters of this distribution. (Knapp-USGS)
W70-01285

**DETERMINATION OF PARTICLE SIZE AND CONCENTRATION FROM PHOTOMETER AND SECCHI DISC MEASUREMENTS,**
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Jerome Williams.
Tech Rep 48, Chesapeake Bay Inst, Johns Hopkins Univ, Ref No 68-18, Nov 1968. 12 p, 3 fig, 3 ref. Available from Clearinghouse as AD-679 169 for $3 in paper copy, 65 cents in microfiche. Proj No NR 083-016, Contract No Nonr 4010 (11).

Descriptors: *Turbidity, *Particle size, *Photometry, *Mathematical models, Opacity, Instrumentation, Estuaries, Bays, Suspended load, Sea water, Optical properties, Light intensity.
Identifiers: Submarine photometers, Secchi disc.

The mathematical model developed by the Chesapeake Bay Institute is extended to allow for direct calculation of particle size and concentration from optical data. The optical parameters utilized are such that black and white Secchi Discs coupled with a submarine filter photometer are the only instruments required to determine equivalent optical radii and particle concentration values. (Knapp-USGS)
W70-01286

**THE ROLE OF THE EQUILIBRIUM CONCEPT IN THE INTERPRETATION OF LANDFORMS OF FLUVIAL EROSION AND DEPOSITION,**
Maryland Univ., College Park.
Frank Ahnert.
Evolution Des Versants, Proc Symp Int de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 23-41, 1967. 19 p, 8 fig.

Descriptors: *Equilibrium, *Geomorphology, *Erosion, *Deposition (Sediments), Topography, Mathematical studies, Climatology, Dynamics, Slopes, Slope stabilization, Weathering, Bedrock, River basin development, Energy.
Identifiers: *Landform dynamics.

The role of the dynamic equilibrium concept in the interpretation of landforms of fluvial erosion and deposition was analytically investigated, neglecting at first the effect of climate, structure, and differential rock resistance. This partial neglect was based on the belief that these factors only modify the removal-supply relationship without invalidating the system concept of relating the rates of supply and removal of the waste to the landform. This concept of equilibrium recognizes the balance of energy entering and leaving the system, where the rates of waste supply and waste removal are merely the measurable expression of this balance. Moreover, this concept of equilibrium permits, besides the continuous passing through of exogenic energy, the discontinuous insertion of endogenic energy in the form of tectonic deformation into the system. (Gabriel-USGS)
W70-01288

**QUANTITATIVE RESEARCH OF SLOPE DEVELOPMENT IN CZECHOSLOVAKIA,**
Czechoslovak Academy of Sciences, Brno. Inst. of Geography.
J. Demek.
Evolution Des Versants, Proc Symp Int de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 111-122, 1967. 12 p, 3 fig, 2 photo, 7 ref.

Descriptors: *Geomorphology, *Slopes, *Slope stabilization, Sediments, Pleistocene epoch, Tertiary period, Erosion, Organic wastes, Soils, Climates, Topography, Plants, Animals, Geology, Runoff, Weathering, Mass wasting.
Identifiers: *Czechoslovakia, Slope development.

Quantitative research on the slope evolution in Czechoslovakia is reviewed. The research consisted of the following broad studies: evolution of the Pleistocene slopes based on the study of correlative deposits; evolution of slopes subjected to cultivation; and the study of slope processes using experimental stream basins. Pleistocene sediments preserved the Tertiary slopes and the thickness of these sediments gives definite data on the importance of the process of denudation. The presence of organic and inorganic material and the petrographic study of these sediments permits the identification of several stages of slope evolution. Data of slope evolution recorded at three experimental areas of central and western Czechoslovakia are included. (Gabriel-USGS)
W70-01289

**CURRENT RIPPLES - THEIR RELATION TO PATTERNS OF WATER AND SEDIMENT MOTION,**
Reading Univ. (England). Sedimentology Research Lab.
John R. L. Allen.
Amsterdam, North-Holland Publishing Co, 1968. 433 p, 443 fig, 15 tab, 538 ref.

Descriptors: *Deposition (Sediments), *Ripple marks, *Sedimentary structures, *Currents (Water), Sand waves, Flow nets, Flow separation, Dispersion, Sediment transport, Flow around objects, Eddies, Bed load, Sediment distribution, Shape, Laboratory tests.
Identifiers: *Reference book, *Current ripples, *Sediment motion, Cross-stratification.

A detailed description of the geometry and occurrence of ripple marks is given in this 19-chapter well written book based upon field and laboratory studies. Several aspects of current ripples are discussed: theory on fluid motion and sediment transport; description of bed forms, their surface anatomy and cross-stratification; fluid and grain motion associated with specific types of ripples; and sedimentation associated with current ripples. The author's analysis shows how streambed geometry and flow properties are related; many illustrations are given of novel fluid motions obtained. Experiments described show that many textural and geometrical properties of deposits can be understood in terms of diffusion and convection of sediments in areas of separated flow. This book gives the geologist and engineer an intellectual challenge and insight into patterns of water and sediment motion. (Lang-USGS)
W70-01292

**MŌVEMENT OF SOIL MASS ON SLOPES IN CULTIVATED AREAS,**
Warsaw Univ. (Poland).
A. Jahn.
Evolution Des Versants, Proc Symp de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 157-165, 1967. 9 p, 5 fig, 8 ref.

Descriptors: *Mass wasting, *Movement, *Slopes, *Cultivated lands, *Erosion, Runoff, Solifluction, Agricultural watersheds, Surface runoff, Washouts, Geology, Clays, Sands, Loess, Silts, River basins, Mass transfer, Soil physical properties, Soil erosion.
Identifiers: Soil mass movement in cultivated areas.

Soil movement on slopes induced by plowing, rain, and surface runoff was investigated by recording pertinent data in the upper Oder River basin of Poland with cultivated slopes of 3 to 18 degrees. Analysis of the process of selective erosion was based on the application of the formula developed by G. W. Musgrave (1947). Selective erosion is stronger on cultivated slopes and is present under natural conditions on the slopes of periglacial areas. On slopes of 10 deg, where plowing is parallel with contour lines, the thickness of the layer shifted annually as much as 10 cm. (Gabriel-USGS)
W70-01295

**DEPOSITION IN THE PROCESS OF HYDRAULIC TRANSPORT,**
R. A. Bagnold.
Sedimentology, Vol 10, No 1, p 45-56, Jan 1968. 12 p, 6 fig, 8 ref.

Descriptors: *Sedimentation, *Sediment transport, *Deposition (Sediments), Hydraulics, Turbulent flow, Bed load, Suspended load, Particle size, Particle shape, Turbulence, Tractive forces, Laboratory tests, Hydraulic models.
Identifiers: Sediment transport theory.

A simple theory is outlined, based on the conservation of energy, whereby such diverse processes as wind-blown and river-transported sediments, mudflows and sand avalanches can be brought together and explained in terms of the established concepts of general physics. It is shown that the mean rate of transport of sediment in turbulent suspension is determined by the whole size distribution of the transported sediment rather than by any arbitrarily defined mean size. This suggests that more detailed studies of the changes which occur in size distributions during the cycle of erosion transport and deposition would throw much-needed light on the underlying processes. (Knapp-USGS)
W70-01409

**STATISTICAL MODELS IN SEDIMENTOLOGY,**
Northwestern Univ., Evanston, Ill.
W. C. Krumbein.
Sedimentology, Vol 10, No 1, p 7-23, Jan 1968. 17 p, 4 fig, 4 tab, 27 ref.

Descriptors: *Statistical models, *Sedimentology, *Reviews, Sedimentation, Regression analysis, Stochastic processes, Computers, Mathematical models, Statistical methods, Systems analysis, Probability.
Identifiers: Sedimentological model studies, Statistical sedimentology.

Three stages of statistical development can be recognized in sedimentology. The first is descriptive statistics, in which the sample is the object of interest, and the second is analytical statistics, in which the population assumes major importance. A very large variety of statistical techniques is available for estimating mean values, degrees of variability, tests of differences among population means, linear relations (correlations) among the variables, and ways of evaluating areal variations (trends) in sedimentary phenomena. The third stage of statistical development is the application of stochastic process models to sedimentology, in which the objective is to discern the probabilistic elements is sedimentary processes, in part by simulation with the high-speed computer. Stochastic process models thus provide one way of examining sedimentary processes through time or over an area. In conjunction with deterministic models they provide a framework for exploring the underlying physical, chemical, and biological controls on sedimentary processes and deposits, with superimposed random fluctuations introduced by the 'built in' probabilistic mechanism. (Knapp-USGS)
W70-01411

**ON ENVIRONMENT-SENSITIVE GRAIN-SIZE PARAMETERS,**
Leiden Rijksuniversiteit (Netherlands). Dept. of Sedimentology.
W. S. Koldijk.
Sedimentology, Vol 10, No 1, p 57-69, Jan 1968. 13 p, 8 fig, 16 ref.

Descriptors: *Sediments, *Deposition (Sediments), *Particle size, *Statistical methods, *Computer programs, Sediment transport, Alluvial channels, Sampling, Settling velocity, Regime.
Identifiers: Sorting (Sediments), Moments (Statistical), Spain.

Moment measures are to be preferred over graphic measures for a reliable description of the depositional environment of sands. This is demonstrated by coarse beach and river sands from the Ria de Arosa (northwestern Spain). A PL/1 computer-program for the calculation of graphic and moment measures has been added to stimulate other comparative studies. (Knapp-USGS)
W70-01412

**ANALYSIS OF THE RELATIONSHIP BETWEEN ACOUSTIC REFLECTIVITY AND SEDIMENT POROSITY,**
Lafayette Coll., Easton, Pa. Dept. of Geology; and General Dynamics Corp., Groton, Conn. Electric Boat Div.
Richard W. Faas.
Geophysics, Vol 34, No 4, p 546-553, Aug 1969. 8 p, 6 fig, 4 tab, 13 ref. ONR Contract Nonr 2512 (00).

Descriptors: *Acoustics, *Porosity, *Sediments, *Physical properties, Mechanical properties, Sounding, Sound waves, Exploration, Geophysics, Clays, Sands, Gravels, Bottom sediments.
Identifiers: Acoustic reflectivity (Sediments).

Ocean-bottom sediment porosity and acoustic reflectivity are related by a simple linear equation. The equation was derived empirically from data published by several investigators and is valid for a wide variety of sediment types and ocean conditions. The degree of validity of the relationship appears to be excellent as the correlation coefficient between the porosity and acoustic reflectivity is 0.97. (Knapp-USGS)
W70-01428

**INTER-ELEMENT ASSOCIATIONS IN SOME PELAGIC DEPOSITS,**
Ottawa Univ. (Ontario). Dept. of Geology.
D. S. Cronan.
Chem Geol, Vol 5, No 2, p 99-106, Nov 1969. 8 p, 2 tab, 21 ref.

Descriptors: *Sediments, *Water chemistry, *Correlation analysis, *Trace elements, Spectroscopy, Chemical analysis, Manganese, Bottom sediments, Clays, X-ray diffraction, Mineralogy.
Identifiers: Pelagic sediment chemistry, Manganese nodules, Electron-probe analysis.

Calculation of correlation coefficients for various pairs of elements in pelagic deposits demonstrates the presence of several inter-element associations. In manganese nodules these are between Mn-Ni-Cu-Mo, Cr-detrital constituents, Co-Pb and Fe-Ti, and in pelagic sediments between V-Cr-Ti and Mn-Ni-Mo. These associations are considered to result largely from the partition of elements between the different mineral phases present in the deposits, and, in the case of the nodules, from variations in their depth of formation. (Knapp-USGS)
W70-01438

**INFLUENCE OF CAPILLARY GROUND MOISTURE ON EOLIAN ACCUMULATION OF LOESS,**
Wroclaw Univ. (Poland). Faculty of Geography.
J. Cegla.
Bull Acad Pol Sci, Ser Sci Geol et Geogr, Vol 17, No 1, p 25-27, 1969. 3 p, 10 ref.

Descriptors: *Capillary water, *Moisture, *Groundwater, *Loess, *Sedimentation, Geology, Topography, Vegetation, Cold regions, Deserts, Petrography, Aeolian soils.
Identifiers: *Poland, Loess accumulation processes.

In many parts of the world, loess deposits blanket uplands and elevated topographical elements. The presence of moisture in the ground may be of primary importance for the accumulation of loess on elevated topographical elements; however, this suggestion does not invalidate the widely accepted view that the climate conditions present during the accumulation of loess were cold and relatively dry. (Gabriel-USGS)
W70-01440

**DEVELOPMENT OF EOLIAN TRANSVERSE RIPPLES AND RIPPLE BEDDING,**
Polish Academy of Sciences, Warsaw. Museum of the Earth.
J. Muller.
Bull Acad Pol Sci, Ser Sci Geol et Geogr, Vol 17, No 1, p 49-56, 1969. 8 p, 4 fig, 18 ref.

Descriptors: *Sedimentary structures, *Aeolian soils, *Ripple marks, *Beds, Seashores, Beaches, Dunes, Hydrodynamics, Mathematical models, Mathematical studies, Stress analysis, Sediment transport.
Identifiers: Ripple mark development.

The conclusions reached during field work carried out mainly on beaches and coastal dunes of the Southern Baltic seashore, and in the laboratory using a simple wind tunnel are summarized. First-stage ripples may be interpreted as local dense concentrations of particles that move closest to the bottom. Development of the second-stage forms is connected with the interaction between the obstacles of the bed and the grainflux. Regular patterns of second- and third-stage ripples develop only in abundance of grains rolling and saltating and in stable conditions of flow. (Gabriel-USGS)
W70-01441

**ACTIVATION ANALYSIS OF SEDIMENTARY ROCK,**
Texas Petroleum Research Commission; and Texas A and M Univ., College Station.
E. M. Chandler, and Paul B. Crawford.
Bull Acad Pol Sci, Ser Sci Geol et Geogr, Vol 17, No 1, p 73-78, 1969. 6 p, 7 fig, 2 tab, 5 ref.

Descriptors: *Sedimentary rocks, *Sedimentary petrology, *Neutron activation analysis, *Analytical techniques, *Analysis, Thermal radiation, Chemical analysis, Silica, Sodium, Magnesium, Iron, Trace elements, Geology, Shales, Limestones, Sands.
Identifiers: Trace element analysis.

Sedimentary rock samples of shale, limestone, and sand were activated with thermal neutrons, allowed to cool and counted. Under certain conditions requiring no wet chemistry, the contents of Si, Al, Na, Mg, Hf, La, Sc and Fe in sedimentary rocks can be qualitatively determined. Sampling procedures and 10-second, one-minute, and 4-hour activation procedures are described. It is of interest that for a short activation time Si, Al, Mg, and Na peaks effectively mask out all trace elements. (Gabriel-USGS)
W70-01442

## 2K. Chemical Processes

**ON THE POSSIBILITY OF GROUNDWATER AGE DETERMINATION USING TRITIUM-HELIUM-3 METHOD (RUSSIAN),**
For primary bibliographic entry see Field 02F.
W70-01282

**PROPERTIES OF SEA WATER AND SOLUTIONS CONTAINING SODIUM CHLORIDE, POTASSIUM CHLORIDE, SODIUM SULFATE AND MAGNESIUM SULFATE,**
Monsanto Research Corp., Everett, Mass.
B. M. Fabuss, and Alexander Korosi.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25. Office Saline Water Res and Develop Progr Rep No 384, 1968. 133 p. OSW Contract No 14-01-0001-466.

Descriptors: *Water chemistry, Sea water, *Water properties, *Aqueous solutions, Sodium chloride, Potassium chloride, Sodium sulfate, Magnesium compounds, Density, Vapor pressure, Viscosity, Thermal conductivity, Boiling, Brines, Correlation analysis, Computer programs.
Identifiers: *Boiling point elevation, Binary solutions, Ternary solutions.

Density, vapor pressure and viscosity were measured and tabulated for: (1) water; (2) binary solutions (NaCl-KCl, Na sulfate, Mg sulfate); (3) ternary solutions (NaCl-KCl, NaCl-Na sulfate, NaCl-Mg sulfate); (4) sea water and its concentrates. Thermal conductivity data of water and sea water as well as boiling point elevation for sea water are also

given. A FORTRAN program is given to calculate densities, activities, and viscosities of brines. Examples of calculation of each property and the correlation techniques used are given. (Carstea-USGS)
W70-01400

**SILICA CONTENT AND SILICA-CLAY INTERACTIONS IN THE WATER OF THE DEAD SEA (ISRAEL),**
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
Ora Amit.
Chem Geol, Vol 5, No 2, p 121-129, Nov 1969. 9 p, 4 fig, 4 tab, 7 ref.

Descriptors: *Water chemistry, *Brines, *Water analysis, *Silica, *Clays, Salinity, Saline water, Adsorption, Ion exchange, Mineralogy, Sorption.
Identifiers: *Dead Sea (Israel).

The concentration of silica in Dead Sea water ranges from about 13-17 ppm at the surface to about 8-10 ppm at depth. Contact with various clay minerals reduces the silica content of Dead Sea water to 2-3 ppm. These relations are the opposite of those obtained in ocean water: free ocean water has less than 1/10 the silica content of Dead Sea water, but oceanic interstitial water is about 10 times as rich in silica as the corresponding Dead Sea water. These differences are attributed to the uptake and release of silica by organisms in the ocean and their absence in the Dead Sea and to the influence of salinity on the solubility of clay minerals. (Knapp-USGS)
W70-01405

**PROBABLE CHANGES IN THE COMPOSITION OF SEA WATER DURING THE COURSE OF GEOLOGICAL TIME,**
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.
A. B. Ronov.
Sedimentology, Vol 10, No 1, p 25-43, Jan 1968. 19 p, 7 fig, 6 tab, 52 ref.

Descriptors: *Geochemistry, *Water chemistry, *Paleohydrology, *Sea water, Oxygen, Oxidation, Ions, Solutes, Aqueous solutions, Oxidation-reduction potential.
Identifiers: Sea water paleogeochemistry.

The geological history of the outer geospheres can be understood only if their chemical interrelationships are taken into account. The excess calcium and magnesium in sedimentary rocks cannot be understood unless the magmatogenous Azoic and Archean volcanic rocks were more mafic than the average composition of the Archean and Proterozoic shields. This leads to the idea that the cationic composition of the ancient ocean was essentially calcium and magnesium. The granitization of the sedimentary mantle in the Upper Archean and Lower Proterozoic was accompanied by the introduction of enormous amounts of alkaline solutions from the mantle into the crust, a growth in the volume of the ocean waters, the beginning of an inversion in the cationic composition and a gradual enrichment in sodium. This developed parallel with the growth of platforms and carbonate deposit formation. The formation of sulfate beds and thick beds of iron ore of the Early Proterozoic was preceded by the oxidation of sulfur and polyvalent metals. These processes were related to the history of carbon dioxide and oxygen in the atmosphere and to the development of life and the biosphere. Thus the Archean-Early Proterozoic boundary marks an epoch of abrupt change in the history of the outer zones of the earth. (Knapp-USGS)
W70-01410

**SELECTIVE ELEMENT RECOVERY FROM OIL FIELD BRINES,**
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Ernest E. Angino.
Pap presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 13 p, 5 fig, 1 tab.

Descriptors: *Desalination, *Oil fields, *Brines, Elements (Chemical), Sodium compounds, Sulfates, Sulfur, Trace elements, Iron.
Identifiers: *Element recovery, Oil field brines.

More than 250 billion gallons of oil-field brines are brought to the surface yearly in the United States. Most of these brines are wasted and/or are returned to the subsurface without any attempt of stripping the salts. In many instances, the salts in oil-field brines could be extracted profitably, if modern extraction techniques were used. Simple extraction processes for soda ash, sodium carbonate, caustic soda, magnesium and calcium sulfate, trace elements and others are available. Sulfur can be recovered by precipitating the sulfate as $BaSO_4$, which can then be made to yield S by a short 4-step conversion process. Magnesium can be precipitated as the hydroxide and selected trace elements can be scavenged by ferric iron precipitation. (Carstea-USGS)
W70-01413

**RELATIONSHIP OF WATER QUALITY AND SOIL PROPERTIES TO SEEPAGE PROBLEMS,**
Seepage Control, Inc., Phoenix, Ariz.
For primary bibliographic entry see Field 02G.
W70-01415

**CHANGES IN WATER QUALITY DURING SEEPAGE,**
California Univ., Davis. Dept. of Water Science and Engineering; and Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W70-01418

**ATOMIC ABSORPTION AND FLAME EMISSION SPECTROSCOPY ABSTRACTS.**

Atomic Absorption and Flame Emission Spectroscopy Abstracts, Vol 1, No 1, Jan-Feb 1969. Science and Technology Agency, 3 Dyers Bldg, London, EC 1, England.

Descriptors: *Abstracts, *Spectroscopy, *Flame photometry, Geochemistry, Water chemistry, Water analysis, Documentation, Publications, Chemical analysis.
Identifiers: *Atomic absorption spectroscopy, Flame emission spectroscopy.

A bimonthly publication contains abstracts and documentation of all aspects of atomic and flame emission spectroscopy. Topics include theory, instrumentation, technique, elements (chemical), biological applications, industrial applications, and geochemical applications. (Knapp-USGS)
W70-01434

**RATES OF REACTION OF DISSOLVED OXYGEN WITH SCAVENGERS IN SWEET AND SOUR BRINES,**
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 08G.
W70-01435

**NITRATE DETERMINATION IN SOIL EXTRACTS WITH THE NITRATE ELECTRODE,**
Norges Landbrukshoegskole, Vollebekk. Inst. of Soil Science; and Norges Landbrukshoegskole, Vollebekk. Chemical Research Lab.
A. Oien, and A. R. Selmer-Olsen.
Analyst, Vol 94, No 1123, p 888-894, Oct 1969. 7 p, 5 tab, 23 ref.

Descriptors: *Analytical techniques, *Nitrates, *Soil water, *Aqueous solutions, *Electrodes, Electrochemistry, Ions, Zeta potential, Chemical reactions, Soil chemistry.
Identifiers: Nitrate determination electrodes.

Investigations were made on nitrate determination with a nitrate-specific ion electrode. Analytical results for the nitrate content in soil extracts are compared with analyses carried out by two colorimetric methods. The extracting agents used are 0.02 N copper sulphate, 2 N potassium chloride and distilled water. Results for nitrate determinations in soil suspensions and corresponding filtrates are also compared. The stability of soil extracts, the influence of variation in the ratio of grams of soil to millilitres of extracting agent and in the shaking time, interferences caused by ionic strength and anions, accuracy and reproducibility are also discussed. Nitrate determination with the electrode is reliable both for soil extracts and for soil suspensions. The determination is rapid, and the interferences are not serious. (Knapp-USGS)
W70-01437

**INTER-ELEMENT ASSOCIATIONS IN SOME PELAGIC DEPOSITS,**
Ottawa Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-01438

**CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION IN SOME REGIONS OF THE USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. A. Matveyev, and O. I. Bashmakova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 3-16, 1967. Soviet Hydrology: Selected Papers No 5, p 480-491, 1967. 6 fig, 4 tab, 35 ref.

Descriptors: *Precipitation (Atmospheric), *Water chemistry, *Water quality, *Salts, Chlorides, Sulfates, Bicarbonates, Calcium, Magnesium, Potassium, Sodium, Carbon dioxide, Hydrogen sulfide.
Identifiers: *USSR, *Atmospheric water chemistry, Sulfur dioxide.

The results of chemical analyses of atmospheric waters in the USSR are summarized. Maps are compiled on the average annual mineralization of atmospheric precipitation of salts with atmospheric precipitation per unit area. These maps show the magnitude of these quantities in various regions of the European USSR with an accuracy of about 15-45%. The concentration of marine salts in atmospheric precipitation varies from 60% of the total mineralization of precipitation in the north to 15% in the central part of the country. The influence of continental factors (eolian suspensions, industry, etc.) is strongest in the regions south of 50 deg N. (Carstea-USGS)
W70-01448

**MICROELEMENTS IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE ASIATIC USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01449

**CONTENT OF INDIVIDUAL GROUPS OF ORGANIC SUBSTANCES IN THE WATERS OF SOME SOVIET IVERS,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01450

**BROMINE AND IODINE CONTENT IN THE WATER OF THE MAJOR RIVERS OF THE USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01451

**VARIATION IN TIME OF THE ISOTOPIC COMPOSITION OF THE SULFUR OF SULFATE IONS IN THE WATERS OF THE DON AND VOLGA RIVERS,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01452

**RARE AND DISPERSED ELEMENTS (MICROELEMENTS) IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE EUROPEAN USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
G. S. Konovalov, A. A. Ivanova, and T. Kh. Kolesnikova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 94-111, 1967. Soviet Hydrology: Solected Papers No 5, p 520-533, 1967. 5 fig, 1 tab, 14 ref.

Descriptors: *Trace elements, *Elements (Chemicals), *Water chemistry, *Suspended load, Watersheds (Basins), Geomorphology, Water quality, Analytical techniques, Copper, Manganese, Cobalt, Dissolved solids.
Identifiers: *European USSR, Lead, Tin, Bismuth.

The contents of V, Mn, Co, Ni, Cu, Zn, Mo, Ag, Sn, Pb, and Bi in suspended and dissolved forms in the waters of the largest rivers in the European USSR depend on the chemical properties of the elements and the physiographic characteristics of river basins. No bismuth has been found in the water or in the suspended material. Lead, tin, silver, and cobalt were found only in suspended substances and only in some rivers. The other elements can be tentatively placed in the following order according to the increase in their dissolved form: V, Mn, Ni, Vn, and Cu. The ratios between the two main forms of the migration of microelements (in suspended substances and in dissolved form) differ considerably by river basin, especially if we compare the rivers of northern and southern basins and lowland and mountain rivers. Ni and Zn migrate not only with suspended substances, but also in dissolved form. (Carstea-USGS)
W70-01453

**COMPOSITION OF ORGANIC SUBSTANCES IN FLOOD WATERS FORMING IN SMALL CATCHMENTS OF THE ARID ZONE,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. D. Semenov, L. I. Nemtseva, L. V. Brazhnikova, A. S. Demchenko, and A. P. Pashanova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 52, p 186-190, 1967. Soviet Hydrology: Selected Papers No 5, p 554-557, 1967. 1 tab, 11 ref.

Descriptors: *Water chemistry, *Small watersheds, *Organic compounds, *Floodwater, Watersheds (Basins), Arid climates, Precipitation (Atmospheric), Soils, Organic matter, Amino acids, Proteins, Nitrates, Nitrites, Ammonium compounds, Sulfates, Dissolved solids, Carbohydrates.
Identifiers: Soil extracts, Soil water chemistry, Sugars.

Atmospheric precipitation and the nature of soils determine the composition of organic compounds in floodwaters of small catchments. Water samples were tested for organic carbon, amino acids, proteins, free reducing sugars, complex carbohydrates, amines, organic acids, complex esters, nitrites, nitrates, ammonium, and sulfates. Snow water and adjacent soil extracts were also analyzed. During flood periods, the amount of dissolved solids in water approached the value found in soil extracts. The amount of dissolved substances was highest in the first day of flood. The content of ammonium ions was higher in the snow water and soil extracts than in the floodwaters. The influence of atmospheric waters is more pronounced in the formation of organic substances in floodwaters than in the formation of inorganic substances. (Carstea-USGS)
W70-01454

**HYDROCHEMICAL MAPS OF THE RIVERS OF KAZAKHSTAN AND THEIR USE FOR THE RAPID FORECASTING OF THE MINERALIZATION AND ION COMPOSITION OF WATERS OF PROSPECTIVE RESERVOIRS,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
I. M. Pavelko, and M. N. Tarasov.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 40-55, 1947. Soviet Hydrology: Selected Papers, No 5, p 495-508, 1967. 17 fig, 2 tab, 18 ref.

Descriptors: *Water management (Applied), *Water resources, *Water quality, Rivers, Forecasting, Ions, Water chemistry, Reservoirs, Maps.
Identifiers: *USSR, *Hydrochemical maps, Kazakhstan.

Maps of minimum, maximum, and weighted average mineralization of the water of rivers in Kazakhstan are compared. These maps, together with the relationships established between ion composition and mineralization, make it possible to judge the limiting values of the mineralization and chemical composition of the rivers of Kazakhstan in their annual cycle. A method is proposed which makes it possible, on the basis of the data obtained, to simplify the computations of the approximate mineralization and ion composition of waters of prospective reservoirs. (Carstea-USGS)
W70-01456

**FORMATION AND STABILITY OF AL, FE, AND MG INTERLAYERS IN MONTMORILLONITE AND VERMICULITE,**
Oregon State Univ., Corvallis.
Dumitru D. Carstea.
PhD Thesis, Oregon State Univ, June 1967. 117 p, 21 fig, 9 tab, 98 ref.

Descriptors: *Clay minerals, *Iron, *Aluminum, *Magnesium, *Analytical techniques, Montmorillonite, Mineralogy, Cation exchange, X-ray analysis, Acidity, Moisture uptake.
Identifiers: *Hydroxy-interlayers formation, Hydroxy-interlayers stability, Vermiculite.

The effects of pH and time on the formation of hydroxy-Al, Fe, and Mg interlayers were compared for montmorillonite and vermiculite. The stability of interlayers was evaluated by sequentially increasing the severity of dissolution treatments and by subjecting the interlayers to an HCl treatment. In montmorillonite, aluminum interlayers were formed at all pH levels. Systems equilibrated in acid media exhibited the greatest degree of interlayering. In vermiculite, aluminum interlayer formation was also greater for acid than for alkaline media. Changes after 6 months and one year were observed for both montmorillonite and vermiculite systems. Moderate amounts of iron interlayers were found in montmorillonite at all pH levels, whereas the alkaline environments favored their formation in vermiculite. Magnesium interlayers in montmorillonite and vermiculite were formed only in alkaline environments (pH greater than 10). The hydroxy-Al, Fe, and Mg interlayers in montmorillonite showed a higher degree of formation and exhibited a higher stability to sequential and HCl treatments than the interlayers formed in vermiculite.
W70-01457

**FURTHER OBSERVATIONS OF HUMUS DECOMPOSITION AND NITRIFICATION,**
East African Agriculture and Forestry Research Organisation, Kikuyu (Kenya).
H. F. Birch.
Plant and Soil, Vol 9, No 3, p 262-286, Sept 1959. 6 fig, 12 tab, 14 ref.

Descriptors: *Nitrification, *Decomposition, *Humus, Organic matter, Soil, Drying, Moisture, Soil chemistry, Nitrogen cycle, Nitrogen compounds, Gels, Soil surfaces, Boundaries (Surfaces), Cycling nutrients.
Identifiers: *Mineralization, Microbial activity, Organic gels, Solubilization, Surface effects, Microbial populations, Chemical processes.

After dry soil is moistened, a short period of rapid organic matter decomposition follows. Author investigated reasons for this phenomena and for mineralization of carbon and nitrogen during this period. Experimental evidence indicated that two processes of organic matter decomposition operate simultaneously: in one, only carbon mineralizes; in another both carbon and nitrogen mineralize. He shows that, after dry soil is moistened, considerable quantities of nitrogenous organic matter dissolve, and such solutions undergo rapid microbial decomposition, in which carbon mineralizes but nitrogen does not. Amounts of soluble organic matter were related directly to length of drying period. Concomitant nitrogen mineralization involves microbial decomposition of nonsoluble organic matter; rate of nitrogen mineralization is associated with surface area of organic gel in the soil. Author postulates that drying organic gels cause their fragmentation or increased porosity, leading to an increased surface area; moistening causes swelling and cohesion of gels, consequently decreasing their surface and eventually reducing rate of organic matter decomposition. Also, high rates of such decomposition following moistening of dry soil and rapid decline in decomposition rates may result from high microbial activity associated with youthful phases of developing microbial populations, followed by declining activity as such populations age. (Graetz-Wisconsin)
W70-01578

## 2L. Estuaries

**HYDROGRAPHY OF THE BALTIC DEEP BASINS III,**
Fishery Board of Sweden.
Stig H. Fonselius.
Fish Board of Sweden, Ser Hydrogr, Rep No 23, 1969. 97 p, 65 fig, 4 tab, 106 ref.

Descriptors: *Hydrography, *Estuaries, *Sea water, Mapping, Topography, Water chemistry, Gaging stations, Chemical analysis, Stagnant water, Oxygen, Hydrogen, Phosphates, Salinity, Water temperature, Density, Runoff, Rivers, Silicates, Nutrients, Water balance.
Identifiers: Baltic basins.

This monograph is a comprehensive study of the hydrography of the Baltic Sea with an emphasis on the stagnation taking place in its deep water basins. Samples of Baltic water were taken from established stations periodically from the beginning of the century. Some characteristics of the Baltic topography produce two water layers separated by a permanent halocline which impedes the mixing of the water layers. The data recorded at various Baltic stations indicate a gradual increase in the salinity and phosphorus content and a decrease in oxygen content of deep waters. Meteorological factors, the decreased runoff of the Baltic area rivers, and the decreased water exchange through the Danish sounds coupled with the increased intensity of the bottom currents in the Belts and Kattegat are responsible for these changes in salinity, oxygen, and phosphorus contents. The implication of the findings is that if there is a continuation of the trends toward increased salinity and phosphorus concentration in the Baltic, the sea's deep water shall soon become devoid of organic life. (Gabriel-USGS)
W70-01245

**TRULLVATNET: A FLANDRIAN STRATIGRAPHICAL SITE NEAR MURCHISONFJORDEN, NORDAUSTLANDET, SPITSBERGEN,**
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
For primary bibliographic entry see Field 02H.

W70-01253

**MARINE RESEARCH, FISCAL YEAR 1968,**
Smithsonian Institution, Washington, D.C. Science Information Exchange.
For primary bibliographic entry see Field 09D.
W70-01261

**VIRGINIA BEACH EROSION COMMISSION.**
For primary bibliographic entry see Field 06E.
W70-01322

**ANALYSIS OF THE RELATIONSHIP BETWEEN ACOUSTIC REFLECTIVITY AND SEDIMENT POROSITY,**
Lafayette Coll., Easton, Pa. Dept. of Geology; and General Dynamics Corp., Groton, Conn. Electric Boat Div.
For primary bibliographic entry see Field 02J.
W70-01428

**A DEEP-SEA ELECTRICAL RESISTIVITY PROBE FOR MEASURING POROSITY AND DENSITY OF UNCONSOLIDATED SEDIMENTS,**
SACLANT ASW Research Centre, La Spezia (Italy).
A. Kermabon, C. Gehin, and P. Blavier.
Geophysics, Vol 34, No 4, p 554-571, Aug 1969. 17 p, 16 fig, 9 ref.

Descriptors: *Electrical resistance, *Bottom sediments, *Instrumentation, Sediments, Oceanography, Electrical studies, Surveys, Exploration, Porosity, Density, Physical properties, Geophysics, Sampling.
Identifiers: Formation factor (Resistivity).

A study was made of the mass physical properties and electrical resistivity of marine sediments. The well-known linear correlation of density with porosity was confirmed. A third-degree polynomial curve was found to be the best fit for data relating porosity and the formation factor, which is the ratio of the bulk resistivity of marine sediments, to the resistivity of interstitial water. An electrical resistivity probe was devised to obtain in-situ profiles of resistivity versus depth. The instrument is 13 m long and weighs 700 kg in water. About 30 rapid measurements on the sea floor can be made in one lowering. Good correlation was obtained between electrical probe measurements and direct porosity measurements made on cores taken nearby. (Knapp-USGS)
W70-01429

**ENERGY DISSIPATION IN A TIDAL ESTUARY,**
Oregon State Univ., Corvallis. Dept. of Oceanography.
Jackson Blanton.
J Geophys Res, Vol 74, No 23, p 5460-5466, Oct 20, 1969. 7 p, 6 fig, 2 tab, 12 ref.

Descriptors: *Energy dissipation, *Tidal effects, *Estuaries, *Tidal energy, Oregon, Mapping, Water temperature, Salinity, Analysis, Mathematical studies, Water circulation, Energy transfer.
Identifiers: *Coos Bay (Ore), Tidal energy dissipation.

The extent and mechanism of the dissipation of tidal energy were investigated in Coos Bay, a coastal plain estuary located on the central Oregon coast. The study consisted in measuring and comparing the energy required to provide the observed mixing and an increase in potential energy with the energy lost through tidal damping. The measured dissipation rate in Coos Bay was 1/10,000 watt/kg. (Gabriel-USGS)
W70-01430

**SEISMIC ATTENUATION OF GULF COAST SEDIMENTS,**
Esso Production Research Co., Houston, Tex.
Frank N. Tullos, and Alton C. Reid.
Geophysics, Vol 34, No 4, p 516-528, Aug 1969. 13 p, 18 fig, 2 tab, 13 ref.

Descriptors: *Seismic studies, *Exploration, *Seismic properties, *Sediments, *Gulf Coastal Plain, Seismology, Stratigraphy, Data collections, Instrumentation, Systems analysis, Fourier analysis.
Identifiers: Seismic attenuation (Gulf Coast sediments).

Seismic attenuation values have now been obtained from normally layered Gulf Coast sediments. After normalizing with respect to the shot, the spectra of many traces over a small interval in depth can be averaged to minimize reflection interference and to yield a frequency response function associated with a given depth. Except for the measurements in the low velocity layer (LVL), a cemented array of geophones 1000 ft deep was used. The LVL measurements were made using individually cemented geophones. Data were taken on a digital recorder using a 0.5 ms sampling rate, and the processing was performed on a digital computer. Attenuation was found to vary exponentially with frequency to the first power in the range from 50 to 400 Hz. The 1000-ft section of earth, made up largely of clay and sand layers, was separated into 4 sections at depths of about 10, 100, and 500 ft. Attenuation in db/wavelength was found to be 13.1, 0.1508, 0.3641, and 0.2004 in the respective sections. (Knapp-USGS)
W70-01432

**PHYSICAL PROPERTIES OF MARINE SEDIMENTS AS RELATED TO SEISMIC VELOCITIES,**
Texas Instruments, Inc., Dallas.
Nabil Morgan.
Geophysics, Vol 34, No 4, p 529-545, Aug 1969. 17 p, 13 fig, 3 tab, 18 ref.

Descriptors: *Seismic studies, *Sediments, *Lake Erie, *Seismic properties, Density, Porosity, Particle size, Stratigraphy, Data collections, Statistical methods, Seismology.
Identifiers: Seismic velocity (Sediments).

An investigation of the dependence of seismic velocities on different physical properties of naturally occurring fresh-water sediments in Lake Erie has been conducted. Cores from one lake bottom were collected and the longitudinal seismic wave velocities as well as the physical properties (grain density, bulk density, porosity, median diameter, and phi deviation) were measured. The data were fitted with a second-order polynomial in all the physical properties to the seismic velocity. Independent variables were ranked according to their individual effect upon the sum of the squares of the regression residuals. A variance-analysis table was set up, and the coefficients were tested by a series of F ratios at certain probabilities. As porosity and bulk density are linearly related, these were not included together in the same model. There are strong indications that the porosity and its square together with the median diameter play a significant role in determining the seismic velocity at the probability of 0.90. At the higher probability of 0.99, the median diameter proved insignificant. The cubic term of porosity is insignificant at the 0.50 level. (Knapp-USGS)
W70-01433

**OCEANOGRAPHIC PROFILING WITH IMPROVED VERTICAL RESOLUTION,**
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 07B.
W70-01445

**PILOT STUDY OF ICE DRIFT IN THE GULF OF ST. LAWRENCE,**
Massachusetts Inst. of Tech., Cambridge; McGill Univ., Montreal (Quebec). Marine Sciences Centre; and McGill Univ., Montreal (Quebec). Dept. of Physics.
For primary bibliographic entry see Field 02C.
W70-01446

# 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

## 3A. Saline Water Conversion

**FIRST VTE PILOT PLANT REPORT, JULY 1, 1967,**
Oak Ridge National Lab., Tenn.
John W. Hill.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $1.25 per copy. Office Saline Water Res and Develop Progr Rep No 367, 1968. 61 p, 18 fig, 2 tab, 2 ref, 3 append. Agreement No 14-01-0001-534.

Descriptors: *Pilot plants, *Desalination plants, *Evaporators, *Evaporation, Fresh water, Sodium chloride, Films, Heat transfer, Sea water, Research and development.
Identifiers: *Oak Ridge National Laboratory, Office of Saline Water, Wrightsville Beach (NC), Rising film, Falling film.

The Oak Ridge National Laboratory tested a pilot plant which could evaporate a maximum of 20,000 gallons of water per day. Both the rising-film and falling-film modes of operation using fresh water and sodium chloride solutions were tested. Evaporator tubes with enhanced surfaces improved heat transfer coefficients. The plant was sent to the Office of Saline Water East Coast Engineering and Development Test Station, Wrightsville Beach, North Carolina for further testing with sea water. Test results, the plant equipment and the proposed test plan are described. (Carstea-USGS)
W70-01269

**A HYDRODYNAMIC THEORY OF DESALINATION BY ELECTRODIALYSIS,**
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
Ain A. Sonin, and Ronald F. Probstein.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.60 per copy. Office Saline Water Res and Develop Progr Rep No 375, Dec 1968. 60 p, 15 fig, 11 ref. Grant No 14-01-0001-1721 (OSW).

Descriptors: *Desalination, *Electrodialysis, Analytical techniques, Membranes, Laminar flow, Model studies, Brines, Diffusion, Density currents, Polarity, Demineralization.
Identifiers: Hydrodynamic theory, Dialysate concentration.

A hydrodynamic theory of demineralization by electrodialysis has been developed for a multichannel system with steady laminar flow between plane, parallel membranes. The modeling of the system is found to be governed by 4 basic similarity parameters: (1) a dimensionless applied potential, (2) the product of the channel aspect ratio and the inverse Peclet number, (3) the ratio of brine and dialysate inlet concentrations, and (4) a parameter measuring membrane resistance. For sufficiently long channels it is shown that there are 2 distinct regions: a 'developing' region where the concentration diffusion layers are growing, and a 'developed' region where the diffusion layers fill the channel. Parabolic and uniform velocity profiles are considered and self-consistent solutions are derived for the distributions of salt concentration, electric field and current density in the system, as well as for the total current. In the limits of low and high polarization analytic solutions are obtained which when matched at their point of equality closely approximate the complete numerical solutions. (Carstea-USGS)
W70-01270

**DESALTING OF SEAWATER BY FREEZING,**
Cornell Univ., Ithaca, N.Y.
H. F. Wiegandt, P. Harriott, and J. P. Leinroth.

Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.50 per copy. Office Saline Water Res and Develop Progr Rep No 376, Dec 1968. 43 p, 3 fig, 14 tab, 33 ref. Contract No 14-01-0001-1141.

Descriptors: *Desalination, *Desalination plants, *Freezing, *Sea water, Economics, Heat transfer, Brines, Condensation, Cost analysis, Water costs, Design.
Identifiers: *Secondary refrigerant freezing process, Butane, Multiple compressors.

The economics of the secondary refrigerant freezing process was evaluated with particular emphasis on large freezing plants. It was found that large economies resulted by using normal butane. The reasons for this are: (1) essentially all heat transfer is by direct contact of butane and water; (2) multiple compressors and module equipment are not required even at 50 mgd. Precooling the brine and condensing butane from the secondary compressor are additional contributing factors to the low water cost. A study of the secondary refrigerant freezing process using normal butane shows a water cost of 29 cents per 1000 gal for a single-train plant producing 50 mgd. The cost increases to 71 cents per 1000 gal for 5 mgd and to $1.76 per 1000 gal for 1 mgd, showing that the freezing process is most suitable for large rather than small or medium plants. (Carstea-USGS)
W70-01271

**RESEARCH ON POROUS GLASS MEMBRANES FOR REVERSE OSMOSIS,**
McDonnell Douglas Astronautics Co., Newport Beach, Calif.
F. E. Littman, and G. A. Guter.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.50 per copy. Office Saline Water Res and Develop Progr Rep No 379, Dec 1968. 44 p, 16 fig, 10 tab, 4 ref. Contract No 14-01-0001-1282.

Descriptors: *Membranes, *Reverse osmosis, *Desalination, Ureas, Nitrates, Phenols, Brines, Temperature, Pressure, Acidity, Heat, Membrane processes.
Identifiers: Porous glass membranes.

The use of porous glass as membrane material for reverse osmosis has been explored in an experimental study using the glass in the form of tublets. Porous glass prepared in this laboratory gave sodium chloride rejections as high as 97% from a 10,000 ppm salt feed. The variables in the process of porous glass fabrication were investigated and correlated with the reverse osmosis properties of the product glass. It has been demonstrated that porous glass membranes can reject a wide variety of materials to about the same extent as sodium chloride. These materials are urea, phenol, nitrates, borates, and magnesium salts. The effects of heat and surface treatment of the glass were studied as well as membrane thickness, brine temperature, pressure, and pH. This study demonstrates that porous glass membranes show considerable potential for use in the reverse osmosis process as a hollow fiber material where adequate fluxes can be realized. (Carstea-USGS)
W70-01272

**HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 1. TRANSPORT BETWEEN LIQUIDS AND SPHERICAL PARTICLES IN A TANK,**
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 01B.
W70-01297

**HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 2. EFFECTS OF TRANSPIRATION AND CHANGING DIAMETER TO SPHERES,**
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 01B.
W70-01298

**PROPERTIES OF WATER AND AQUEOUS SOLUTIONS AT HIGH PRESSURES AND TEMPERATURES,**
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 01A.
W70-01299

**OPERATION OF A 50,000 GPD PORTABLE REVERSE OSMOSIS PILOT PLANT,**
Aerojet-General Corp., El Monte, Calif.
E. R. Watson.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25. Office Saline Water Res and Develop Progr Rep No 430, May 1969. 63 p, 18 fig, 18 tab, 5 append. OSW Contract No 14-01-0001-930.

Descriptors: *Pilot plants, *Desalination plants, *Reverse osmosis, *Desalination, Membranes, Cellulose, Bacteria, Aqueous solutions, Chlorine, Research and development, Manganese.
Identifiers: *Cellulose acetate membrane, Formaldehyde.

Efforts were made to establish several major operational requirements for desalination pilot plants. Cellulose acetate membranes can be destroyed by certain types of bacteria, therefore, assembly must be done under sterile conditions. Treatment of the membrane stack assembly with about 2% aqueous solution of formaldehyde can prevent the bacterial damage. Manganese deposits form on the membrane surface when chlorine is used for bacterial protection. This precipitation occurred in water with a manganese content of 0.8-1.4 ppm. Stable operation of the pilot plant is feasible at an operating pressure as low as 450 psi. More research is needed to study the relationship between membrane size and pressure in order to achieve 50,000 gpd. (Carstea-USGS)
W70-01396

**SEA WATER CORROSION TEST PROGRAM,**
Dow Chemical Co., Freeport, Tex.
H. C. Behrens, F. D. Martin, O. Osborn, L. Rice, and W. B. Russell.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25. Office Saline Water Res and Develop Progr Rep No 417, Mar 1969. 107 p, 30 fig, 6 tab, 20 ref, 3 append. OSW Contract No 14-01-0001-1090.

Descriptors: *Sea water, *Corrosion, *Alloys, *Copper, *Desalination processes, Dissolved oxygen, Acidity, Velocity, Temperature, Deaeration, Turbulence, Brines, Hydrogen sulfide, Magnesium hydroxide, Calcium carbonate.
Identifiers: *Sea water corrosion, Deaerators, Water refreshment rate.

The weight losses of 6 copper alloys tested for corrosion resistance in sea water were measured under different conditions of dissolved oxygen concentration, pH, temperature, velocity and water refreshment rate. The corrosion rate seems to be very highly correlated with oxygen concentration. Extremely low weight loss was noted under low dissolved oxygen conditions (less than 5 ppb). For this reason, every effort should be made in desalination plants to provide feedwater deaerators to keep the levels of oxygen below 5 ppb. At low oxygen levels, water velocity, water turbulence and temperatures in the range of 180-250 deg F had minor or no effects upon corrosion rates. At low oxygen levels, the pH of the feedwater should be as high as possible without promoting precipitation of Mg hydroxide or Ca carbonate. The effect of hydrogen sulfide in the heated water can be nullified through controlled oxygen additions. The quantities of brine recirculated should be held to a minimum if the dissolved oxygen is low. Corrosion monitors should be installed at critical locations throughout a plant. (Carstea-USGS)
W70-01397

**DEVELOPMENT OF LOW PRESSURE REVERSE OSMOSIS MEMBRANES AND DESIGN OF A SMALL UNIT FOR BRACKISH WATER,**
Dartmouth Coll., Hanover, N.H.
John L. Brock, Peter M. Fahey, Christian S. Miller, and D. Dean Spatz.
Research supported by contract by Office of Saline Water. Office Saline Water Res and Develop Progr Rep No 441, June 1969. 273 p, 75 fig, 9 tab, 62 ref. OSW Contract No 14-01-0001-1644.

Descriptors: *Desalination plants, *Reverse osmosis, *Membranes, *Brackish water, *Desalination, Potable water, Cellulose, Electron microscopy, Analytical techniques, Permeability, Research and development, Pressure, Design.
Identifiers: *Reverse osmosis membranes, Porous cellulose acetate membranes, Polyester filter paper, Home desalination appliances.

A household appliance which produces 3 to 5 gallons per day of potable water from brackish water is described. Its operation is based on reverse osmosis and the water pressure present in the household water system in the only required power source. A pilot system that extrudes the basic Sourirajan-Loeb membrane solution onto a continuous sheet of tough polyester filter paper produces reverse osmosis membranes. The characteristics of porous cellulose acetate membranes are reported for brackish water feed for low pressure. Direct experimentation and electron microscopy were used to study the membrane structure. (Carstea-USGS)
W70-01399

**PROPERTIES OF SEA WATER AND SOLUTIONS CONTAINING SODIUM CHLORIDE, POTASSIUM CHLORIDE, SODIUM SULFATE AND MAGNESIUM SULFATE,**
Monsanto Research Corp., Everett, Mass.
For primary bibliographic entry see Field 02K.
W70-01400

**DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,**
North Star Research and Development Inst., Minneapolis, Minn.
L. T. Rozelle, J. E. Cadotte, R. D. Corneliussen, and E. E. Erickson.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price 45 cents. Office Saline Water Res and Develop Progr Rep No 359, Oct 1968. 59 p, 19 fig, 8 tab, 19 ref, 4 append. OSW Contract No 14-01-0001-1143.

Descriptors: *Desalination processes, *Membrane processes, *Reverse osmosis, Membranes, Cellulose, Films, Analytical techniques, Electron microscopy, Anisotropy, Desalination.
Identifiers: *Ultrathin membranes, *Anistropic membranes, *Support membranes, Beta-glucan acetate, Cellulose acetate.

Ultrathin membranes, anistropic membranes, and support membranes for reverse osmosis were studied. Ultrathin membranes of Beta-glucan acetate were as effective as cellulose acetate (CA) in reverse osmosis desalination. Beta-glucan acetate has shown promise as a new polymer for anisotropic membranes. A polysulfone film was developed that has a greater potential as a support film for ultrathin membranes than the cellulose acetate film. Also polysulfone is more inert chemically than CA. This is important if in situ chemical and replacement techniques for ultrathin membranes are to be developed. An interferometry method was developed for directly measuring the thicknesses of ultrathin membranes. Electron microscopy studies indicated that Beta-glucan acetate had a wavy surface structure, and that the surface of CA was smooth with isolated fibrils. (Carstea-USGS)
W70-01401

**THERMOPHYSICAL PROPERTIES OF SALINE WATER,**
Monsanto Research Corp., Everett, Mass. Boston Labs.
Alexander Korosi, and Bela M. Fabuss.

Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $0.45. Office Saline Water Res and Develop Progr Rep No 363, Sept 1 968. 53 p, 8 fig, 20 tab, 44 ref. OSW Contract No 14-01-0001-466.

Descriptors: *Thermal properties, *Physical properties, *Saline water, Thermodynamics, Thermal conductivity, Viscometers, Sea water, Sodium chloride, Instrumentation, Viscosity, Density, Potassium compounds, Sodium sulfate, Magnesium compounds, Temperatures, Electrolytes, Aqueous solutions.
Identifiers: Binary electrolyte systems, Ternary electrolyte systems, Multicomponent electrolyte systems, Glass capillary viscometers.

Thermal conductivity was measured in water, NaCl and sea water solutions in the temperature range of 25-150 deg C, using transient rather than steady state methods. The molalities of NaCl solutions were 0.7 and 3.5, and the solute concentration in the synthetic sea water corresponded to the ionic strength value of normal and three-fold concentrated sea water. Experimental viscosity and density measurements were made on electrolyte solutions containing one or two of the major sea water components, NaCl, KCl, sodium sulfate and Mg sulfate, dissolved in water. The viscosity of liquid water from 75 deg to 150 deg C was measured in a special glass capillary viscometer pressurized with hydrogen. The experimental results on binary, ternary and multicomponent electrolyte systems were correlated using Othmer's rule which establishes a linear relationship between the logarithm of viscosity of an aqueous solution and that of water at the same temperature. (Carstea-USGS)
W70-01402

**NEUTRON INELASTIC SCATTERING STUDIES OF WATER AND IONIC SOLUTIONS,**
Union Carbide Corp., Tuxedo, N.Y.
G. J. Safford, P. S. Leung, and P. C. Schaffer.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402. Office Saline Water Res and Develop Progr Rep No 372, Aug 1968. 69 p, 16 fig, 4 tab, 82 ref, 2 append. OSW Contract No 14-01-0001-372.

Descriptors: *Analytical techniques, *Water, *Aqueous solutions, Water properties, Salts, Hydrates, Ions, Molecular structure, Bonding, Desalination.
Identifiers: *Neutron inelastic scattering, Diffusion coefficient, Solid salt hydrates.

Slow neutron inelastic scattering was used to measure the intermolecular frequencies between 900/cm and 8/cm of water molecules in pure water and in aqueous solutions of La chloride, Ca chloride, Mg chloride, CsI, CsCl, KSCN, KI, KBr, KCl, KF, NaCl, Li nitrate and LiCl. The diffusion coefficients of water molecules in various aqueous solutions were also determined. Small or highly charged ions break existing water structure and form complexes with scattering bonds similar to those of water molecules in the corresponding solid salt hydrates. Salt solutions with larger charged ions also show new scattering bonds which, at lower temperatures, are broader and less pronounced than for smaller or highly charged ions. (Carstea-USGS)
W70-01403

**ENERGY AS A FACTOR OF PLANNING IN THE FIELD OF SEA WATER DESALINATION INGENIEURGESELLSCHAFT FICHTNER, STUTTGART-FEUERBACH, GERMANY,**
W. Fichtner.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 445-52 (1967). 2 fig. Paper No SWD/105.
Identifiers: *Energy costs, *Energy sources, Dual-purpose plant, Flash evaporation, Fossil fuels, Nuclear energy sources.

Emphasis is on the dual-purpose plant utilizing the multistage flash distillation method and energy supplied by steam power stations. A comparison of fossil fuel-fired plants vs nuclear-powered plants indicates that small desalination plants should utilize fossil fuel, whereas large plants should use nuclear power. Plant size should not solely determine the type of heat generation mechanism to be used. Other factors such as the relations between fuel heat costs and power selling costs, as well as alterations expected during the operating time of a plant should be taken into consideration. Characteristics of dual-purpose seawater distillation plants are given, as is a comparison of the economics of a nuclear power plant and a fossil fuel-fired plant for seawater distillation (17C MGD).
W70-01521

**EVALUATION OF ALL POTENTIAL SOURCES OF ENERGY FOR DESALTING,**
Ebasco Services, Inc., New York.
For primary bibliographic entry see Field 08C.
W70-01522

**GAS TURBINES PROVE EFFECTIVE FOR DESALINATION,**
Stal-Laval Turbine Co., Finspang, Sweden.
For primary bibliographic entry see Field 08C.
W70-01523

**ORGANIC-COOLED HEAVY-WATER-MODERATED REACTORS -- AN APPROACH TO LARGE-SCALE DUAL-PURPOSE PLANTS,**
Atomics International, Canoga Park, Calif.
C. Starr, S. Golan, and D. V. Graf.
Water Production Using Nuclear Energy, Ed by R G Post and R L Seale, p 253-72, 1966. 9 fig, 4 ref. Univ Arizona Press, Tucson. Proc Am Nucl Soc Symp, Mar 1966,
Identifiers: *Energy sources, *Heavy-water/organic-cooled reactors, *Nuclear energy sources, Converter reactors, Dual-purpose plant economics, Economic evaluations, Multistage flash distillation, Plant layout, Water costs estimate, 250 plus MGD plant.

Current light-water reactors are generally more attractive as energy sources than fossil plants in large plant sizes and low fuel cost nuclear heat sources such as the heavy-water reactor and fast breeder are of special interest for future large power and desalting applications. The HWOCR is particularly suitable because of a unique combination of design and operating characteristics. A layout is given for A 1-BGD, 3400-MWE (net) dual purpose plant that will utilize two 8250-MWT HWOCR units in parallel. Plant economics, performance characteristics, and a plant availability analysis are included. The steam developed by the nuclear heat source will power five 800-MWE back-pressure turbines exhausting steam at 25 PSIA to the brine heaters of ten 100-MGD multistage-flash evaporators. The total investment for such a plant is estimated at $1.05 billion. If the power can be sold at 2.0 mills/KWH, the product water cost will be about 13 cents/1000 gal.
W70-01524

**FRESH WATER FROM NUCLEAR POWER WITH THE AGR AND SGHWR,**
United Kingdom Atomic Energy Authority, Risley (England).
For primary bibliographic entry see Field 08C.
W70-01525

**NUCLEAR REACTORS FOR SEA-WATER DESALINATION.**
Iowa State Univ., Ames.

Presented at Am Soc Mech Engr Meeting, New York, Nov 27-Dec 1, 1966. Paper 66-WA-NE-21.
Identifiers: Applications of nuclear energy, Boiling-water reactors, Breeder reactors, Converter reactors, Dual-purpose plant, Economic evaluations, Energy costs, Pressurized-water reactors, Single-purpose plant, Water costs estimate.

Primarily on the basis of nuclear reactor principles and technology, current and near term converters and long range breeders for seawater desalination are analyzed. The trends of current and near term converters and the full utilization of uranium and thorium energy resources in developing fast and thermal breeders are discussed. Comparisons of single-purpose and multipurpose nuclear desalting plants from economic and technological considerations are also given. Water cost and steam cost are estimated for single-purpose and dual-purpose (with electric power credit of 3.65 mills/KWH) desalting plants at various reactor sizes up to 2400 MWT. Water costs were estimated to be about 30 cents/1000 gal for dual-purpose plants with 1600 MWT or larger reactors. Process steam from this size reactor was estimated at 30 cents/MBTU for a dual-purpose plant or 48 cents/MBTU for a single-purpose plant.
W70-01526

**A FUEL CYCLE ECONOMIC ANALYSIS OF OXIDE FUELED POWER AND PROCESS HEAT PWR FOR SEAWATER DESALINATION,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08C.
W70-01527

**THE UNCLAD-METAL BREEDER REACTOR (UMBR) FOR DESALTING OR POWER,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08C.
W70-01528

**THE OPTIMAL DESIGN OF DESALINATION SYSTEMS,**
Kansas State Univ., Manhattan.
L. T. Fan, C. Y. Cheng, L. E. Erickson, and C. L. Hwang.
2nd European Symp Fresh Water from Sea, Vol 4, Athens, May 1967. Desalination 3, 225-36, 1967. 14 fig, 17 ref.

Descriptors: *Economic evaluations, Design, Membrane processes, Flash distillation, Osmosis, Water costs estimate.
Identifiers: Multiple effect distillation.

Process analysis and optimization studies have been made for a multi-effect multistage flash distillation system and a multistage reverse osmosis system. In the distillation system, the heat supplied to the brine heater, the brine reject concentration, the recirculation rates within each effect, and the allocation of brine temperature and composition among the effects are controlled to arrive at an optimal policy. In the reverse osmosis process, multistage operation is compared with single-stage operation. The recirculation rates in each stage, the allocation of brine composition among the stages and the operating pressures in each stage are controlled to arrive at the optimal operating condition. A flow-work exchanger is incorporated into the reverse osmosis system and its quantitative advantages are examined under optimal conditions. A discrete form of the maximum principle in combination with other optimization techniques has been used for most of the optimization studies.
W70-01530

**ECONOMIC EVALUATION OF DESALTING SUB-SYSTEM AS A PART OF THE TOTAL WATER SYSTEM,**
California Univ., Los Angeles.
J. M. English, and N. El-Ramly.
Desalination 3, 308-17 (1967). 5 fig, 4 ref. Also preprints 2nd European Symp Fresh Water From Sea, Vol 4, Athens, May 1967.

Descriptors: *Economic evaluations, *Feasibility studies, Capital costs, Cost allocation, Water utilization.

Engineering and economic feasibility studies of projected desalination plants have been confined to single developments. The cost of desalted water is

compared with that of alternative supplies. A higher unit cost for water from a desalination plant as compared with other sources could be justified. The economics of desalination is considered from the viewpoint of the total water system of which the conversion plant may be only a component. The concept of limited planning horizon is discussed, and the water system is synthesized in relation to the long-term demand function. The alternative of a mix between the surface water collection systems and desalination is introduced. The optimum mix is determined on the basis of minimizing the present worth of costs in relation to demand. Through the use of continuous discounting (interest) and exponential approximations for the demand functions, the effects of the rate of return and rate of growth in demand on the optimum plant characteristics are shown in a direct, simple manner. With respect to individual water supplies, capital cost is allocated over the life of the plant in proportion to the demand pattern, and an equivalent marginal water pricing concept is formulated. This price is then minimized, and optimum life, investment and capacity are thereby determined.
W70-01531

**SELECTION OF PARAMETERS OF AN ATOMIC ENERGY PLANT WITH HIGH PRODUCTIVITY DISTILLATION OF SEA WATER,**
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
L. S. Sterman, N. A. Mozharov, and V. V. Gubenko.
Desalination 5, 95-106 (1968). 5 fig, 4 ref. Also preprints 2nd European Symp Fresh Water From Sea, Vol 4, Athens, May 1967.

Descriptors: Capital costs, Dual-purpose plant, *Economic evaluations, *Nuclear desalination, Operating costs.
Identifiers: Pressurized-water reactors, 0-3000 MW (T) reactors.

Based on thermal economics, capital investment, and operational charges, the optimum parameters and power of an atomic power plant are selected. The method given for techno-economic analysis of nuclear energy plants of the PWR type generating electrical and heat energy allows one to choose the initial steam parameters at the turbine entrance, under different exhaust pressures. Techno-economic calculations for nuclear dual-purpose plants with reactor capacities of 760 MW (T) and coolant pressures in the first circuit equal to 100 ATM show that, for the same generation of electrical energy, minimum expenditures on heat given to the desalination plant correspond to a coolant temperature at the entrance to the reactor of 220 deg C with an exhaust pressure of 2 ATM. Increase in the thermal flux in the active zone (achieved by decreasing the marginal coefficient) leads to a marked decrease in specific calculated charges.
W70-01532

**DUAL-PURPOSE NUCLEAR POWER AND DESALTING PLANTS,**
Bechtel Corp., Los Angeles, Calif.
W. H. Wilson.
Water Production Using Nuclear Energy (Ed by R G Post and R L Seale), p 369-82, Univ. Arizona Press, Tucson (1966). 5 fig. (Proc Am Nucl Soc Symp, Mar 1966, Tucson).
Identifiers: *Dual-purpose plant economics, *Metropolitan water district, *Multistage flash distillation, *Siting surveys, Capitalized costs, Conceptual designs, Dual-purpose plant, Economic evaluations, Flash evaporation, Nuclear desalination, Water costs estimate, 51-250 MGD plant.

Background for and description of a 150-MGD, 1,600 MW (Net) dual-purpose plant to be used as a supplementary source of water and power for the metropolitan water district of southern California. A multi-stage flash distillation process was found most suitable, with a conceptual design consisting of three parallel 50-MGD plants. The cost of water was calculated for the desalting plants with top brine temperatures of 195-250 deg F, with the lowest cost water produced at a top brine temperature of 250 deg F. Capital costs for the dual-purpose plant, based on October 1965 wage and price levels, is $133,100,000, for the Bolsa Island site. A cost comparison between fossil- and nuclear-fueled plants shows that, based on an annual use of 75% natural gas and 25% fuel oil, at a cost of about 35 cents/mbtu desalted water from a fossil-fueled plant would cost 25% more to produce than that from a nuclear-fueled plant. The cost of water at the desalting plant was 21.9 cents/1000 gallons, with an extra five cents required to transport the water to the Diemer Filtration plant.
W70-01533

**GUIDELINE FOR UNIFORM PRESENTATION OF DESALTING COST ESTIMATES.**
Parsons (Ralph M.) Co., Los Angeles, Calif.

OSW R and D Progr rept no 264 (July 1967). 49 p, 3 fig.

Descriptors: *Economic evaluations, *Operating costs, *Water costs estimate, Capital costs, Cost allocation, Direct costs, Fixed costs, Indirect costs.

Guidelines and formats for computing and uniformly presenting estimated costs of desalted water by any process are provided. The method of cost centers has been selected for application to the economic analysis of desalting plants so that attention may be readily focused on basic elements of the complete plant. The costs are categorized into capital cost centers, recurring cost centers, and O and M cost centers. Examples of the format and a general outline for a report presenting the results of an economic analysis are given. Guidelines for preparation of the capital cost estimate meet the following objectives completeness, current costs, simplicity and uniformity of presentation, ease of evaluation and analysis, segregation of process equipment from site and service facilities, and adaptability to various methods of cost allocation in multipurpose plants. Each item to be included in the capital cost estimate is discussed in detail. To determine the cost of water, annual fixed and O and M costs are estimated to be the uniform average for the life of the plant. Each item in these cost categories is discussed separately. The cost of water is influenced by the method of desalting, the relation of the plant to its surroundings and other economic factors.
W70-01534

**NUCLEAR DESALTING - FUTURE TRENDS, AND TODAYS COSTS,**
Applied Research and Engineering Ltd., Durham (England).
R. Starmer, and F. Lowes.
Chem Eng 75 (19), 127-34 (1968). 9 fig, 9 ref.

Descriptors: *Flash distillation, *Reviews, Energy, Nuclear desalination, Nuclear energy, Water costs.

The total installed capacity of MSF plants throughout the world is rapidly increasing and should reach over 90 MGD by 1970. A target is for 1-BGD plants in 1980-90 producing water at 10-15 cents/1000 gal. The most important cost component of an MSF evaporator is the condenser tubing. Tubes of the longest practical length should be used (the limit appears to be 105 ft due to transportation difficulties). Optimizing evaporator performance depends greatly on the cost of steam. Large capacity plants offer a significant saving in capital cost per unit of product - about 40% saving would be expected when increasing the plant size from 5 to 50 MGD. Economics favor fossil fuels over nuclear for dual-purpose plants up to about 200 MGD. However, in special areas where fossil fuels are very cheap (say 5 cents/mbtu) they would have an advantage at even higher capacities. Reactor systems are being advanced and operating conditions improved. However, the largest single factor in reducing reactor cost is an increase in the size of the reactor unit. The trend must be toward a fast-breeder reactor system.
W70-01535

**BRIDGING THE DESIGN-FABRICATION GAP IN THE CONSTRUCTION OF MAMMOTH DESALTING PLANTS,**
Chicago Bridge and Iron Co., Ill.
A. N. Chirico, and T. R. Livingstone.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 773-87 (1967). 2 fig, 6 tab.

Descriptors: *Economic evaluations, Reviews, Water costs.
Identifiers: 0-50 MGD plant, 51-250 MGD plant.

There is no design-fabrication gap. Seawater can be converted to fresh water with present knowledge. There are 3 basic reasons why construction of large desalination plants is not occurring at an accelerated rate consistent with the needs (1) fear of obsolescence, (2) psychological cost barriers, and (3) apprehensiveness in size extrapolation. However, it is doubtful that the cost of desalted water can be reduced to less than 50 cents/1000 gal in 50-MGD plants within the next 20 years. A dual-purpose plant may lower water costs to 30 cents/1000 gal if the cost of fuel is not prohibitive. For this reason, nuclear fuel sources are now being considered for large conversion plants. There are tremendous capital and operating economies which reduce the cost of water drastically when dual-purpose technology is utilized. The only hope of reducing water cost to a level making it both commercially and domestically acceptable would be in integrating the production of power and water. It is obvious that procedures must be established to clearly differentiate and designate the responsibilities of government, designer-constructors, architect-engineers, utility companies, and the consumer.
W70-01536

**A REPRESENTATIVE DESIGN OF NUCLEAR POWER/DESALTING PLANTS NOW AVAILABLE,**
General Electric Co., San Jose, Calif; and Chicago Bridge and Iron Co., Oak Brook, Ill.
F. E. Crever, D. C. Maxwell, A. N. Chirico, and T. R. Livingstone.
Paper presented at Nuclex-66 Meeting, Basel, Switzerland, Sept 8-14, 1966. 51 p, 7 fig.

Descriptors: Brine heater leakage, Control systems, Cost allocation, Design, Water costs.
Identifiers0-3000 MW (T) reactors, 0-50 MGD plant, *Conceptual design, Brine heater leakage.

This report covers a conceptual design study of a nuclear dual-purpose electrical power-MSF distillation plant based on current technology. Design details normal to present-day reactors and water plants are not discussed. The plant capacity is 50 MGD and 300 MWE saleable. The heat source is a 1300 MWT BWR. Many design, control, and cost features peculiar to the dual-purpose concept are considered in detail. These features include water plant and brine heater construction, control of the brine heater pressure levels and the overall plant, and cost allocation between the power and water plants. Product water cost is estimated to be about 30 cents/1000 gal. The report includes detailed cost estimates, a computer printout of the water plant optimization study, a plant layout drawing, and a flow diagram including the reactor plant. An unusual feature is a discussion and analysis of brine heater leakage problems. This section includes a tabulation by isotope of the radioactive constituents in typical BWR condensate.
W70-01537

**QUESTIONS OF SEA WATER DESALINATION PLANT DESIGN,**
W. Fichtner.
Presented at 2nd European Symp Fresh Water From Sea, Vol 4, Athens, May 1967. Desalination 3, 252-58 (1967). 4 fig.

Identifiers: *Dual-purpose plant economics, *Economic evaluations, Boiling-water reactors, Coupling (Reactor-desalting plant), Fossil fuels, Fuel costs, Nuclear desalination, Product ratio, Water costs estimate, 0-50 MGD plant.

A comparison is presented of product ratio and water cost for full backpressure 50-MGD dual-purpose desalination plants with light water nuclear power stations (approximately 65 ATM saturated steam) vs fossil-fueled power stations (approximately 180 ATM 540/540 deg C). The seawater maximum temperature is 110 deg C (230 deg F). The specific heat consumption (performance ratio) of the desalination plant is varied from 40 to 120 mcal/cu.m. The power cost is determined by assuming a market value for power of 5.0 to 7.5 mills/kwhr. The results show that the product ratio (kwh/cu.m.) for the nuclear power station is approximately 60% that of the fossil fuel power station under equivalent conditions. Also, for nuclear fuel costs of 0.70 $/gcal and fossil fuel costs of 1.50 $/gcal the product water costs are approximately equivalent. Results are presented for fossil fuel costs of 1.25, 15.0 and 1.75 $/gcal.
W70-01538

**U.S.-MEXICO-IAEA STUDY OF LARGE NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHERN MEXICO,**
Office of Saline Water, Washington, D.C.
J. A. Hunter.
Paper SM-113/38 presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 20 p, 10 fig.
Identifiers: *Dual-purpose plant, *Feasibility study, *Mexico, *Southwest United States, Agriculture, Capitalized costs, Economic evaluations, Energy sources, Liquid-metal fast-breeder reactors, Multistage flash distillation, Nuclear desalination, Nuclear energy sources, OSW sponsored, Siting surveys, Vertical tube evaporators, Water costs estimate, Water utilization, 3000 plus MW (T) reactors.

Results of a study by a joint IAEA-U.S.-Mexico team to determine the technical and economic practicability of a dual-purpose nuclear-powered plant to supply water and power for the region comprising the southwest U.S. and Northern Mexico. The team determined that a plant sufficient to meet 1980 water needs should be of 1 bgd capacity with two light water reactors of 5000 MW (T) each, producing 2000 MW of electricity. Advanced plant technology assumed for 1990 includes use of liquid metal fast breeder reactors and vertical tube evaporators coupled with multistage flash for brine heating. Capital and annual cost data were developed for three possible sites - Tiito, San Luis, and Santa Clara areas, using interest rates of 4%, 6%, 8%, and 10%, with 30-year life assumed for dual-purpose plant and 50-year life for civil works associated with water conveyance and power transmission. For 1980 plant, water costs range from 16 to 40 cents/1000 gal, with power costs from 1.8 mills to 3.1 mills/kwhr. For 1990 plant, water cost estimates range from 9 to 31 cents/1000 gal, while power costs vary from 1.1 mills/kwhr at 4% fixed charge range to about 2.5 mills/kwhr at 10% fixed charge rate.
W70-01539

**NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.**
International Atomic Energy Agency, Vienna (Austria).

Report TID-24767 (Sept 1968). 377 p, 83 tab, 69 fig.
Identifiers: *Dual-purpose plant, *Feasibility study, *Mexico, *Southwest United States, Agriculture, Capitalized costs, Economic evaluations, Energy sources, Liquid-metal fast-breeder reactors, Multistage flash distillation, Nuclear desalination, Nuclear energy sources, Siting surveys, Vertical tube evaporators, Water costs estimate, Water utilization, 3000 plus MW (T) reactors.

A preliminary assessment conducted by a joint United States, Mexico, and IAEA study team. The team concluded that dual-purpose nuclear plants are a technically feasible method of supplying freshwater and electricity to the states of Mexico and U.S. that border the lower Colorado River. Such plants could provide the required quantities of water and could enhance the quality of water in the region. The initial plant studied produce 1 bgd of water and 1700 mwe saleable power. Based on 1966-67 prices, the project would cost from $8,500,000 to $1 billion as the fixed charge rate changes from 4% to 10%. Water costs at the distribution center would vary from 15.5 to 33 cents/1000 gal for the lowest cost location depending upon fixed charge rates to 17 to 40 cents/1000 gal for the greatest cost location. Electricity costs would vary from 1.8 mills/kwh at 4% fcr 3.1 mills/kwh at 10% fcr. The preliminary economic assessment leads the study team to recommend that further detailed studies be conducted to firmly establish the economic practicability of such plants. Summary is available as report TID-24681.
W70-01540

**TRENDS IN DESALINATION.**

Nucl Eng 13, 854-58 (1968). 12 fig, 3 tab.

Descriptors: *Nuclear desalination, *Reviews, Distillation processes, Dual-purpose plant economics, Energy costs, Energy sources, Water costs estimate.

A short review of 13 different methods being used or considered for the provision of fresh water supplies from salt or brackish water together with a survey of lines of development, project proposals, and cost studies. From a review of various cost studies it would appear that a nuclear-powered dual-purpose desalting plant would produce the lowest cost water. Calculated costs range from 24 to 54 cents/1000 gal of product water.
W70-01541

**WATER DESALTING COST - PRESENT AND FUTURE,**
International Atomic Energy Agency, Vienna (Austria).
D. B. Brice.
In Isotope and Radiation Techniques in Soil Physics and Irrigation Studies, p 403-21, (Proc Symp, Istanbul, June 12-16, 1967), Intern At Energy Agency, Vienna (1967). 6 fig, 11 ref.
Identifiers: *Distillation processes, *Nuclear energy sources, *Water costs estimate, Breeder reactors, Dual-purpose plant, Dual-purpose plant economics, Economic evaluations, Energy sources, Multistage flash distillation, Nuclear desalination, Reviews, Vertical tube evaporators.

Some of the more promising processes for desalting, such as multistage flash distillation and long tube vertical evaporation, are described. Electrodialysis is normally used for brackish water. A MSF plant requires a thermal energy input of 50,000 or more kcal/cu.m. A substantial reduction in the cost of water would be realized if an inexpensive source of energy such as nuclear energy were available. By the end of 1966 nuclear reactors in operation had a total capacity of 9000 MW (E). This should increase to 35,000 MW (E) by 1970 and 100,000 MW (E) by 1975. Improvements are expected to bring the cost of steam 18 cents/mbtu by mid-1970s, to 12-15 cents with advanced converters in the late 1970s and to 6-10 cents with breeder reactors by the early 1980s. Scale formation limits the temperature usable in a MSF plant, whereas electric power costs are lowest when steam is produced at high temperatures. Thus the advantage in dual-purpose plants. The water-to-power ratio in dual-purpose plants is limited at present to 0.8-0.8 mgd/MW (E), depending on the type of reactor. Projected water cost estimates are as low as 23 cents/1000 gal and further into the future perhaps 11 cents/1000 gal.
W70-01542

**FACTORS INVOLVED IN THE ECONOMIC PRODUCTION OF USABLE FRESH WATER FROM SALINE SOURCES,**
Powell (Sheppard T.) and Associates, Baltimore, Md.
S. T. Powell.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 429-44 (1967). 4 fig, 5 tab. (Paper SWD/100).
Identifiers: *Economic evaluations, *Waste disposal, Brine system designs, By-product economics, Corrosion, Corrosion control, Fixed costs.

Removal of oil detergents, insecticides, miscellaneous organic compounds (the most serious contaminants in coastal waters), and saline supplies which contain iron (above 0.5 ppm) will raise the cost of the finished water. The use of steel pipe in saline well construction (design life of well 20 yrs) is being considered because of its availability, initial cost, and the ease of construction. However, steel well castings equipped with slotted screens have a limited life in brackish formations (as low as 2 yrs in some instances). This rapid deterioration has been due to screen plugging and general fouling by corrosion from the water or from the corrosive properties of the formation in which wells have been located. Corrosion can be minimized by using insulating couplings (nonmetallic castings). Brine disposal (20,000 tons per day for a system of 150-MGD capacity) is very costly for inland plants but is not considered a major cost problem for coastal sites. It does create a thermal pollution problem. Total costs for brine disposal for plants (15 to 50 MGD) vary from 1.8 to 3.2 million dollars, depending on plant size. Water costs may be less if magnesium, bromine, fluoride or other products can be converted from the brine disposal.
W70-01545

**COASTAL DESERTS - PRIME CUSTOMERS OF DESALINATION,**
International Geographical Union, Wayland, Mass.
P. Meigs.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 721-36 (1967). 2 fig, 1 tab, 11 ref. (Paper SWD/85).
Identifiers: *Site selection criteria, *Water utilization, Agriculture, Geography.

Much of the information given is from a study entitled the geography of coastal deserts (Paris, UNESCO). Methods of heat generation discussed are solar radiation and oil deposit utilization for small desalination plants. Advantages of coastal desalination plants are (1) availability of unlimited supplies of seawater which can be pumped to the desalination plant at less cost than inland brackish or saline water, (2) convenient discharge of residual brine directly into the ocean, (3) cheap ocean transportation of equipment and fuel, and (4) food provided from the seawater.
W70-01546

**MINERAL BY-PRODUCTS FROM THE SEA,**
Grace (W. R.) and Co., Clarksville, Md.
M. L. Salutsky, M. G. Dunseth, and O. B. Waters, Jr.
OSW R and D Progr Rept No 91, PB-181 588 (1964). 130 p, 17 fig, 81 tab, 27 ref.
Identifiers: *By-product manufacturing processes, *Chemical by-products, *Feedwater treatment, *Fertilizer, By-product economics, Chemical production, Ion exchanging, Removal from feedwater, Calcium, Scale prevention.

Experimental investigations were carried out toward the recovery of potassium, calcium, magnesium boron, and other elements from seawater. Means for significantly improving the recovery of potassium were found. However, at the present state of development a potassium fertilizer from this source would cost 2 to 3 times more than from conventional sources. The best method found for the removal of calcium was a modification of classical lime-soda process. This would remove up to 90% of the calcium from seawater at a cost of

about 18.8 cents/1000 gal. In other studies it was found that a slurry of superphosphate fertilizer in seawater can be converted to a solution of sodium phosphate by continuous ion exchange, that the ammonia requirements in a descaling process could then be reduced by about one-third, and that the phosphate recovery from a continuous ion exchange contactor is 97-99%. Three methods were explored for the recovery of boron from seawater, distillation as trimethyl borate, coprecipitation with magnesium hydroxide, and adsorption on preformed magnesium hydroxide. The latter two methods may be valuable for the recovery of boron because of their simplicity. Two methods were explored for the concentration of a mixture of metallic elements, concentration on magnesium ammonium phosphate and adsorption on magnesium hydroxide.
W70-01548

**THE PRODUCTION OF AMMONIUM NITRATE FERTILIZER BY USING LOW-COST ENERGY FROM A NUCLEAR DESALINATION REACTOR,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03F.
W70-01549

**PRECIPITATION OF SULFATE SALTS FROM SALINE SOLUTIONS,**
Grace (W. R.) and Co., Clarksville, Md.
J. Block, and O. B. Waters, Jr.
OSW R and D Progr Rept No 305 (Jan 1968). 59 p, 26 fig, 34 tab, 17 ref.
Identifiers: *By-product manufacturing processes, *Physical properties, *Precipitation, Brine concentration ratio, Chemical by-products, Chemical production, Economic evaluations, OSW sponsored, Waste disposal, Wastes.

An experimental investigation of the solid and liquid phases in the system calcium sulfate - sodium sulfate - water. Measurements were made in the temperature range 25 to 100 deg C and with sodium chloride concentrations from 0 to 4.0 molal. Phase and solubility diagrams are given for the various conditions. A preliminary economic evaluation was made on a sodium sulfate recovery process based on a 3-to-1 seawater brine concentrated further to 10-to-1 by solar evaporation. The reaction was run at 70 deg C. At the current price level of sodium sulfate, this process was found to be uneconomical.
W70-01550

**A CLOSED-CYCLE PROCESS FOR PREVENTING SCALE FORMATION IN EVAPORATORS AND PRODUCING INDUSTRIAL CHEMICALS AT A NUCLEAR DESALINATION PLANT,**
Oak Ridge National Lab., Tenn.
R. E. Blanco, W. C. Yee, W. E. Clark, J. M. Holmes, and R. Salmon.
Report ORNL-4057 (Sep 1967). 51 p, 12 fig, 42 ref.
Identifiers: *Chemical production, *Feedwater treatment, *Fertilizer, *Scale prevention, Flowsheets, Multipurpose plant, Scaling.

Caustic and sodium carbonate are added to seawater to precipitate greater than 95% of the calcium as calcium carbonate at ph 9.2. After removal of the precipitate, the ph is decreased to 7 by adding hydrochloric acid to permit evaporation (to a 4x concentration) at 350 to 400 deg F without scale formation. Caustic, chlorine, and hydrogen are produced from concentrated seawater in a conventional industrial electrolytic cell. The calcium carbonate is calcined to produce sodium carbonate for further descaling. Hydrochloric acid for ph adjustment is produced by the combination of 6% of the hydrogen and chlorine. An optional feature is the production of fertilzier either (1) by combining electrolytic hydrogen and nitrogen from air liquefaction to produce ammonia or (2) by combining this ammonia with excess carbon dioxide from calcined calcium carbonate to produce urea. An economic evaluation based on the production of 1 bgd of fresh water showed that a private company could detain revenue from the sale of excess chlorine and hydrogen and could provide the descaling service for a fee of 1 cent/1000 gal.
W70-01551

**RECOVERY OF SALTS FROM SALINE WATERS VIA SOLVENT EXTRACTION,**
Dow Chemical Co., Walnut Creek, Calif.
R. R. Grinstead, and J. C. Davis.
OSW R and D Progr Rept No 320, Jan 1968. 118 p, 28 fig, 45 ref.
Identifiers: *Chemical by-products, *Feedwater treatment, *Waste disposal, By-product manufacturing processes, Chemical production, Experimental data, OSW sponsored, Removal from feedwater, Magnesium, Solvent extraction.

The results of a study of the chemistry of mixed ionic extractant systems and their possible application to the recovery of by-products from desalination brines. In water-toluene systems, amines exhibit a wide spread in apparent base strength, which has been shown to be mainly a result of differences in tendency of the amine salts to aggregate in toluene. The order of increasing extraction of simple inorganic anions by these systems is nitrate, bromide, chloride, bicarbonate. Extraction studies are reported with mixed ionic systems, consisting of alkylammonium carboxylates, which extract both components of an inorganic salt. The same order of preference for anions is observed as for amines alone. The order of decreasing extraction of cations is calcium, magnesium, sodium, potassium.
W70-01552

**MINERALS FROM SEA SALT,**
Yale Univ., New Haven, Conn.
J. A. Tallmade, J. B. Butt, and J. S. Herman.
Ind Eng Chem 56 (7), 44-65, 1964. 3 fig, 332 ref.
Identifiers: *By-product economics, *Chemical by-products, Bibliographies, By-product manufacturing processes, Chemical production, Fertilizer, Literature surveys, Reviews, Seawater chemical analysis.

A comprehensive review and evaluation of methods of recovering minerals from the large quantities of concentrated brines and salt mixtures resulting from desalination. Such recovery is a possible means of income to reduce the cost of fresh water from a desalting system. Specific processes are classified as those pertaining to recovery of halogens, major metals (Sodium, Magnesium, Calcium, and Potassium), and minor and trace elements. Processes are also designated as to whether mixed salts or multiple products are involved. All the elements are present in some measure in the salts from the sea. Some 39 presently considered worth recovering range from chlorine with a concentration of 18,980 ppm to gold at 0.000006 ppm. Separation methods reviewed include precipitation, electrolysis, electrodialysis, adsorption, ion exchange, chelation, oxidation, chlorination, solvent extraction, and solar evaporation.
W70-01553

**THE SEA AS A SOURCE OF DISSOLVED CHEMICALS,**
Dow Chemical Co., Freeport, Tex.
W. F. McIlhenny, and D. A. Ballard.
In selected papers on desalination and ocean technology, ed by SN Levine, Dover Pub, Inc, New York, 1968. p 1-15, 2 tab, 35 ref. Also preprint AM Chem Soc Meeting, Los Angeles, Apr 1963.
Identifiers: *By-product economics, *Chemical by-products, By-product manufacturing processes, Chemical production, Literature surveys, Reviews, Seawater chemical analysis.

From the dissolved salts (166 million tons/cu mi) in seawater, only common salt, sodium and potassium compounds, calcium and magnesium compounds, magnesium metal, and bromine have been produced in commercial quantities. In search of profitable methods of producing other minerals and metals, Dow studied a hypothetical factory processing 2 million acre-ft of seawater annually. Some 50 dissolved chemicals ranging in amounts from 54 million tons of sodium to less than 0.02 tons of gold would pass through the factory each year. Annual operating costs of $12 million derived for a chemical separation plant alone (or $3 million for a plant operating in conjunction with a saline water conversion plant) proved prohibitive. It was concluded that production of not one of the 35 elements below the concentration of those presently produced commercially, or any combination of them, would be profitable. Many elements (iron, copper, aluminum, zinc, lead, tin, nickel, manganese, and mercury) greatly diluted in seawater are concentrated several hundredfold or thousandfold by various species of marine plants or animals. Improvement of technology of culturing, nurturing, and harvesting these marine organisms may present a solution. Use of ion exchange beds, ionic membranes, and selective electrodialysis may prove profitable.
W70-01554

**AGRICULTURAL WATER BY NUCLEAR DESALINATION AND TECHNICAL ROUTES TO ITS ACHIEVEMENT,**
Oak Ridge National Lab., Tenn.
R. P. Hammond.
Water Production Using Nuclear Energy, Univ Arizona Press, Tucson. (Proc AM Nuclear Soc Symp). Ed. by R. G. Post and R. L. Sealey, p 337-58, Mar 1966. 7 fig, 11 ref.
Identifiers: *Agriculture, *Water utilization, Economic evaluations, Nuclear desalination, Reviews, Water costs estimate.

An analysis is made of cost components of large-scale seawater desalting to show where we stand using presently available reactors and evaporator technology and the areas where improvements must be made to achieve various levels of agricultural water cost. Water at $65/acre-foot is within reach of present technology, but no large-scale agricultural use is anticipated until the price can be brought down to the $45-$30 range. Solution of this problem requires (1) development of one or more approaches to a single-purpose plant (or one producing only a little power), (2) rapid development of low-cost, high-performance evaporators, (3) development of nuclear reactors which can supply energy at much lower cost than present reactors, and (4) experimental and prototype plants which can be scaled up to sizes far larger than would ever be needed for city water sources.
W70-01557

**TECHNOLOGY NEEDED FOR THE ECONOMIC USE OF DESALTED WATER IN AGRICULTURE,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03F.
W70-01559

**PROGRESS ON THE DESIGN OF MULTIFLASH EVAPORATORS,**
Weir Westgarth Ltd., Glasgow (Scotland).
J. M. Stewart, and W. R. Querns.
Desalination 3, 139-46, 1967. 4 fig. Presented at 2nd European Symp Fresh Water from Sea, Vol 8, Athens, May 1967.
Identifiers: *Multistage flash distillation, *Reviews, Component designs, Component development, Design, Evaporators, Layout, Product water purity.

Recent progress in the design of multiflash evaporators is outlined with particular reference to improvements in performance and efficient use of materials. Cost reduction and efficiency are expected to advance gradually through development of existing ideas, rather than because of any sudden major breakthrough. One possibility to be guarded against is that, because of keen worldwide competition, designers might resort to cost cutting

procedures detrimental to both customer and the science. Also discussed are the chemical problems of desalting by flash evaporators. Solutions are examined, with possible avenues for additional study suggested. As part of a large experimental program in the United Kingdom, Weir Westgarth Ltd. in association with the Ukaea has built at troon on the Ayrshire coast of Scotland a large research and development station which will accommodate very large modules for brine flow tests, as well as smaller, more sophisticated plants for corrosion and scale prevention tests. The multiflash system is expected to be the leading method of desalination until at least 1980-85.
W70-01565

**THERMODYNAMIC PROPERTIES OF SEA-WATER AND ITS CONCENTRATES,**
Monsanto Research Corp., Everett, Mass.
For primary bibliographic entry see Field 01A.
W70-01566

**SOME PHYSICAL PROPERTIES OF SEA WATER IN VARIOUS CONCENTRATIONS,**
National Engineering Laboratory, East Kilbride (Scotland).
For primary bibliographic entry see Field 01A.
W70-01568

**PITTING OF TITANIUM ALLOYS IN SALINE WATERS,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08G.
W70-01569

**RESEARCH ON CORROSION MECHANISMS IN SALINE WATER, USING REVERSIBLE AND IRREVERSIBLE ELECTRODES,**
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 08G.
W70-01571

**PROPERTIES OF SEA WATERS AND ITS CONCENTRATES UP TO 200 DEG C,**
California Univ., San Diego, La Jolla.
For primary bibliographic entry see Field 01A.
W70-01572

**INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE - 3,**
AEC, Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 10.
W70-01573

## 3B. Water Yield Improvement

**POTABLE WATER EXTRACTED FROM THE AIR - REPORT ON LABORATORY EXPERIMENTS,**
Royal Inst. of Tech., Stockholm (Sweden). Dept. of Hydraulics.
B. Hellstrom.
J Hydrol, Vol 9, No 1, p 1-19, Sept 1969. 19 p, 12 fig, 1 tab, 2 ref.

Descriptors: *Water supply, *Condensation, *Air conditioning, *Humidity, *Separation techniques, Water vapor, Condensers, Thermodynamics.
Identifiers: Water extraction (Humid air).

Experiments to extract water from the air were carried out in the laboratory by means of a commercial air-conditioning plant (dehumidifying unit). Air was drawn through the unit by a fan, and the amount of water produced was collected, measured, and analyzed. The feasibility of this method was fully proved by the experiments. The extracted water might be expensive, but the method is intended as an alternative in those places where water is very costly or only very small quantities are required. (Knapp-USGS)
W70-01246

**STATISTICAL EVALUATIONS OF A CLOUD-SEEDING PROGRAM AT THE STREAMFLOW CONTROL LEVEL,**
Washington State Univ., Pullman. Coll. of Economics and Business; and Washington Water Research Center, Pullman.
Millard Hastay, and John S. Gladwell.
J Hydrol, Vol 9, No 2, p 117-135, Oct 1969. 19 p, 2 fig, 8 tab, 9 ref.

Descriptors: *Cloud seeding, *Evaluation, *Washington, Statistical methods, Forecasting, Streamflow forecasting, Regression analysis, Least squares method.
Identifiers: Cloud seeding evaluation, Skagit River (Wash).

During the winters of 1962-63 and 1963-64 cloud-seeding operations were undertaken on the Skagit River (Washington) watershed. Conditions required that the statistical evaluation be made at the streamflow control level. A combination of least squares regression with principal components analysis is developed. This requires preliminary screening of variables using a liberal (0.01 level of significance) critical region, followed by the orthogonalization procedure of principal components. Final stepwise regression analysis using the principal component scores and the 0.05 level of significance follows. Tests are consistent with treating the residuals as Gaussian, homoscedastic, and non-autocorrelated. The analysis is replicated in various ways. Without exception, the excess of actual over predicted flows for the full period of the experiment was significant at 0.01 'or higher' level. However, whereas the excess in 1964 is invariably significant at the 0.005 'or higher' level, the 1963 excess would not be judged significant by itself at the 0.05 level. This is explained by a five-fold increase in seeding between 1963 and 1964. Two years subsequent to the period of seeding are analyzed: observed flows fail to show significant deviations from expected flows. Estimates indicate at least 15% runoff increase from seeding. (Knapp-USGS)
W70-01247

**WATER SUPPLY IN COLD REGIONS,**
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W70-01259

**COMBINED WEATHER AND VEGETATION MODIFICATION PROMISES SYNERGISTIC STREAMFLOW RESPONSE,**
Washington State Univ., Pullman. Coll. of Agriculture.
Donald R. Satterlund.
J Hydrol, Vol 9, No 2, p 155-166, Oct 1969. 12 p, 2 tab, 15 ref.

Descriptors: *Cloud seeding, *Watershed management, *Water yield improvement, Rainfall-runoff relationships, Evapotranspiration, Runoff, Hydrogeology, Water yield.
Identifiers: Synergistic effects.

The potential effect of simultaneous application of cloud seeding and vegetation modification of target watersheds was tested using Thornthwaite water balance models. Combining practices often produces a synergistic interaction that increases runoff from treated woodland watersheds over the sum of the two practices applied separately. The synergistic gain appeared in 29 of 30 tests, using climatic data from wooded areas of the United States. Increased runoff attributable to synergistic interaction ranged from 0 to 43 mm annually, with quantities exceeding 25 mm annually appearing commonly from wooded regions of the dry Southwest. The validity of the tests and significance of the results are discussed, with the conclusion that water-short nations cannot afford to overlook this potential for increasing their water supply. (Knapp-USGS)
W70-01264

**THE DEFINITION OF THE TERMS HYDROLOGICALLY ARID AND HUMID FOR AUSTRALIA,**
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W70-01267

## 3C. Use of Water of Impaired Quality

**NATURAL CONTAMINATION HAZARDS IN ARID BASINS,**
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-01485

**MINERALIZED SPRINGS AND THEIR EFFECT ON UTAH'S WATER SUPPLIES,**
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-01486

**WATER COST IN DEVELOPING COUNTRIES,**
J. Barnea.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 737-52 (1967). 5 ref.
Identifiers: *Water costs estimate, *Water utilization, Siting surveys.

Surveys by UN experts show that the bulk of water consumed in developing countries is used for irrigated agriculture. Normally, groundwater is cheaper than desalinated water, and nonagricultural sectors of an economy can afford higher water costs. Blending and mixing of desalinated water with brackish water can improve the quality of the brackish water, increase the quantity of water, and, in effect, reduce the cost of the desalinated water. A UN survey shows that in Madras State (India) the use of 1000 imperial gallons of water for rice cultivation yields a gross agricultural income of $0.05. Construction of a dam will provide water in the Manabi province of Ecuador on the Portoviejo River for $0.011/1000 gal, on the Calceta River for $0.03/1000 gal. The average costs of groundwater are given as being from $0.01 to $0.10/1000 gal.
W70-01544

**A CONCEPTUAL NUCLEAR ENERGY CENTER FOR THE CO-PRODUCTION OF AGRICULTURAL CHEMICALS AND DESALTED WATER TO SERVE A PILOT FOOD FACTORY,**
Department of the Interior, Washington, D.C.
S. A. Bresler, and E. F. Miller.
Preprint SM-113/24 of Paper Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 18 p, 8 fig, 7 ref.
Identifiers: *Agriculture, *Economic evaluations, *Water utilization, Capitalized costs, Chemical by-products, Chemical production, Conceptual designs, Cost breakdowns, Electrochemonuclear systems, Energy costs, Feasibility study, Multipurpose plant, Agro-industrial complexes.

Results of a study of a thermodynamically balanced water-ammonia complex. A flowsheet is presented with charts summarizing the preliminary cost estimates and unit costs for each primary product as determined by the available energy method of cost allocation given in IAEA tech. rept. ser. no. 80. Outlined is a method of adjusting the flowsheet to larger scaled operations, i.e., in giant food factories, to achieve a better ammonia-agricultural water balance through the addition of facilities for the parallel production of steam, electric power and synthetic motor fuel. High pressure steam or electric power could be used to increase the production of water by utilizing a vapor compression recycle in conjunction with a multistage flash plant. Additional electric power could be used on site for the production of phosphoric acid and mixed fertilizers. Conclusions are that it would be feasible to construct and operate a pilot food facto-

ry of the kind described using presently available nuclear and chemical engineering technology.
W70-01556

**DESALTING SALINE IRRIGATION WATER SUPPLIES FOR AGRICULTURE - A CASE STUDY, LOWER COLORADO RIVER BASIN, U.S.A.,**
Bureau of Reclamation, Denver Colo.; and Office of Saline Water, Washington, D.C.
J. T. Maletic, E. S. Krous, and M. S. Sach.
Preprint SM-113/37 of paper presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 18 p, 12 ref.
Identifiers: *Agriculture, *Land utilization, *Multistage flash distillation, *Water utilization, Electrodialysis process, Feedwater treatment.

A case study involving 10,570 irrigable acres near Yuma, Arizona, was performed to evaluate potential applications of multistage flash distillation (MSF) and electrodialysis (ED) processes to desalting water for agriculture. Costs and benefits of desalting water at concentrations of 2600 and 5330 ppm to concentrations of 1500, 900, and 400 ppm were determined. Benefits result from shifts to more profitable cropping patterns, increasing crop yields, reducing water use, reducing costs for water application and drainage, and increasing the flow of farm products from the project. Costs are based on project features such as desalting plants and steam generating equipment, raw water collection facilities, storage reservoirs, conveyance and distribution system, brine disposal system, blending facilities (MSF only), Gypsum addition system (ED only), and water treatment facilities. Benefit-cost ratios based on yield projections to year 1990 were negligible with water of 5330 ppm desalted to 1500 ppm, but this increases to 1.62 with desalting to the 400 ppm level. Benefit-cost ratios varied from negligible at 1500 ppm to 1.72 at 400 ppm when the feedwater source was 2600 ppm. Investment costs were high, ranging from $5000 to $8200/acre. Desalting is expected to be important in the future of agriculture, but competition with other water development possibilities will be involved.
W70-01561

## 3E. Conservation in Industry

**NUCLEAR ENERGY CENTERS - INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES,**
Oak Ridge National Lab., Tenn.
J. W. Michel.
Preprint SM-113/32 of Paper Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 37 p, 21 ref, 13 fig.
Identifiers: *Agriculture, *Agro-industrial complexes, Breeder reactors, Cost breakdowns, Economic evaluations, Energy costs, Energy sources, Evaporators, Nuclear energy sources, Water utilization.

Results of a 1967 study at ORNL to determine the technical and economic feasibility of nuclear-powered industrial and agro-industrial complexes. Basic information was developed on the cost of producing industrial products requiring significant amounts of electricity and of producing a variety of basic food corps. The general economics of combining a nuclear-electric generating station, an industrial complex, and a large agricultural enterprise into an agro-industrial complex was evaluated for both near-term and far-term technologies for the nuclear desalting plant. The effects on the economic return of size, changes in product mix and sales price levels, and of operation with bypass steam to reduce the generation of electricity were also determined. Five typical coastal desert locales in India, Sinai, Baja, California, Peru, and western Australia were briefly examined to test the adaptability of this concept to real world conditions.
W70-01560

**MINING AND WATER CONSERVATION.**

Pa Stat Ann Tit 52, secs 1406.2, 1406.5 (Supp 1969).

Descriptors: *Pennsylvania, *Mining, *Surface waters, *Water conservation, Legislation, Legal aspects, Water supply, Drainage, Permits, Coal mines, Administrative agencies, Bodies of water, Rivers, Streams, Coals, Surface drainage.

The purposes of this act are: (1) the protection of the health, safety, and general welfare of the people by providing for the conservation of surface land areas which may be affected by bituminous coal mining; (2) the enhancement of land values; (3) the preservation of surface water drainage and public water supplies; and (4) generally the improvement of the use and enjoyment of lands. Part of the application to the Department of Mines and Mineral Industries for the operation of a mine consists of a map or plan which must include, in addition to other specified information, the locations of all bodies of water, rivers, and streams in proximity to the proposed operation. (Keith-Florida)
W70-01570

## 3F. Conservation in Agriculture

**SALT BALANCE AND CRITICAL DEPTHS OF GROUND WATERS OF THE PART OF THE VAKH VALLEY UNDER IRRIGATION FOR MANY YEARS (RUSSIAN),**
Yu. G. Planin.
Izvestiya Akad Nauk, Tadzhik, SSR, Otdeleniye Fiziko-Matematicheskikh i Geologo-Khimicheskikh Nauk, No 2 (28), p 83-95, 1968. 9 tab, 7 ref.

Descriptors: *Irrigation, *Salt balance, *Leaching, *River basins, Salinity, Infiltration, Precipitation (Atmospheric), Irrigation effects, Reclamation, Water quality, Geology, Drainage, Water source, Water chemistry, Calcium, Sodium, Magnesium, Sulfates, Temperature, Humidity, Vegetation, Evapotranspiration.
Identifiers: *USSR, Vakh River irrigated basin.

The principles of reclamation of long-term irrigated lands were investigated on the basis of hydrologic, geologic, and atmospheric data recorded in a selected 156-ga-area of the Vakh basin, USSR, 1960 to 1963. Loss of salt is associated with drainage waters and this loss exceeds the amount of salt brought by irrigation waters. Chloride, sodium and magnesium sulfate are the most actively leached elements. The smallest loss is shown by gypsum and calcium carbonates. The cause of both positive and negative salt exchange is poor stability of the salt regime. In general, a zone of relatively active salt exchange must be not less than 15 to 20 inches thick. Empirical formulas were used for the determination of critical depths. (Gabriel-USGS)
W70-01447

**AUTOMATION OF SURFACE IRRIGATION SYSTEMS,**
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
Howard R. Haise, and E. Gordon Kruse.
'Automation of Irrigation and Drainage Systems.' Proceedings National Irrigation and Drainage Spec Conf, ASCE, Phoenix, Ariz p 175-200, Nov 13-16, 1968. 13 fig, 9 ref.

Descriptors: *Surface irrigation, *Turnout gates, *Laterals, Automatic control, Water distribution.
Identifiers: *Fluidic diverters, *Water-powered cylinders, *Center pivot gates, Float valves.

Two systems for automating surface irrigation are described. One uses pneumatic valves remotely controlled by tone telemetry to open and close turnouts at timed intervals. The other uses water-powered cylinders activated by float valves to operate center pivot gates. Large fluidic diverters have also been evaluated for irrigation applications. The automation components can be adapted to furrow, border dike, and basin irrigated fields supplied by open ditches or buried pipelines. Several field systems have been installed and evaluated.
W70-01481

**AUTOMATION OF SURFACE IRRIGATION WITH FLUIDIC DIVERTERS,**
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
E. G. Kruse, P. A. Freeman, and H. R. Haise.
Presented at annual meeting of the ASAE, Purdue Univ, Lafayette, Ind, June 22-25, 1969; to be published in Trans of the ASAE.

Descriptors: *Electronic sensing, *Control components, *Mechanical gate structures, Siphons.
Identifiers: *Fluidic technology, *Fluidic diverters, *Throat dimensions, *Controlled fluid, Bowles Engr'g Corp, Distribution structures.

Fluidic technology has been developed within the past 10 years. Fluidic devices control the flow of fluids using no moving parts and often utilize the energy of the flowing fluid as a source of power for control of the devices. Fluidic devices are easily interfaced with mechanical or electronic components of a control system. In irrigation applications, a large fluidic element can be used to divert the irrigation stream from conveyance to distribution structures and back, using either fluid or electronic sensing and control components. In other applications, smaller fluidic elements may perform the control function, with the weight or pressure of the controlled fluid being used to actuate mechanical gate structures. Experimental fluidic diverters developed by the Bowles Engineering Corp., Silver Springs, Md., with throat dimensions ranging from 1/4 x 1/4 inch up to 8 x 8 inches appeared to have application in automation of surface irrigation systems. This paper describes the results of a cooperative study, laboratory and field, to evaluate feasibility of utilizing large or small fluidic diverters to switch irrigation streams directly or in conjunction with mechanical gates or siphons.
W70-01482

**THE PRODUCTION OF AMMONIUM NITRATE FERTILIZER BY USING LOW-COST ENERGY FROM A NUCLEAR DESALINATION REACTOR,**
Oak Ridge National Lab., Tenn.
J. M. Holmes, R. Salmon, R. E. Blanco, and J. W. Ullmann.
Report ORNL-TM-2202 (Apr 30, 1968). 20 p, 4 fig, 31 ref.
Identifiers: *Chemical production, *Multipurpose plant, By-product economics, By-product manufacturing processes, Chemical by-products, Energy sources, Fertilizer, Flowsheets.

The cost of producing ammonium nitrate was estimated and compared with that for the conventional steam-methane process. Hydrogen was produced by the electrolysis of water with advanced-type cells and power costs varying from 1 to 3 mills/kwhr. Nitric acid, ammonia, and ammonium nitrate were produced with the hydrogen by conventional methods. The capital cost of the nitric acid plant was reduced by about 8% by using oxygen from the electrolysis plant instead of air. Nitrogen for the ammonia plant was recovered from the nitric acid tail gas. The results showed that ammonium nitrate produced in a 698-ton/day plant using power at 1.6 mills/kwhr could compete with the product from a conventional reforming plant using 31 cent/mbtu natural gas. If oxygen credit is allowed, electrolysis would compete with plants using 20 cents/mbtu natural gas. At larger plant sizes, the comparison is less favorable to the electrolytic process, because of its poorer scaling factor. At 2330 tons/day of ammonium nitrate, 1.6 mills/kwhr electricity competes with 34.5 cents natural gas, assuming no oxygen credit. The

average U.S. industrial gas price in 1963 was about 34 cents/mbtu.
W70-01549

**AGRICULTURAL WATER BY NUCLEAR DESALINATION AND TECHNICAL ROUTES TO ITS ACHIEVEMENT,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W70-01557

**TECHNOLOGY NEEDED FOR THE ECONOMIC USE OF DESALTED WATER IN AGRICULTURE,**
Oak Ridge National Lab., Tenn.
R. P. Hammond, and T. D. Anderson.
Preprint SM-113/27 of paper presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 12 p, 2 fig.
Identifiers: *Agriculture, *Water utilization, Agro-industrial complexes, Breeder reactors, Economic evaluations, Energy costs, Energy sources, Evaporators, Heat transfer improvements, Nuclear energy sources.

A summary of the present economic position of desalting in agriculture and of technological developments of nuclear reactors, desalting plants, and crop production which are necessary to improve this position, for reactors, two important factors will affect future energy costs - the advent of very large units and the arrival of advanced breeders. The economic consequences and probable timing of each of these are discussed. For seawater evaporation equipment, the importance of enhanced heat transfer surface and large size plants on economics is emphasized, and recent developments in this direction are summarized. In agricultural technology, controlled production conditions may be expected to provide an environment in which new inputs of crop breeding, nutrient control, and efficient water application may result in outputs per unit of water used far beyond present productions.
W70-01559

**DESALTING SALINE IRRIGATION WATER SUPPLIES FOR AGRICULTURE - A CASE STUDY, LOWER COLORADO RIVER BASIN, U.S.A.,**
Bureau of Reclamation, Denver Colo.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03C.
W70-01561

**PROCEDURES FOR ESTIMATING IRRIGATION WATER REQUIREMENTS,**
Bureau of Reclamation, Denver, Colo.
Don Robb.
Preprint of Papers Presented at Intern Hydrol Symp, Sept 1967, Fort Collins, Colo. 8 p, 2 fig, 5 ref.
Identifiers: *Agriculture, *Water utilization, Agronomy, Ground water recharge, Soil structure.

Part of a study to develop better procedures for estimating the various factors which comprise the total irrigation water requirement - crop consumptive use, effective precipitation, distribution losses, surface runoff, and deep percolation. Preliminary data show that the most common cause of lower than optimum irrigation efficiencies, after differences of soil type, slope, and climate have been eliminated, is lack of sufficient information on the part of the irrigator about when to apply water and how much to put on. Farm efficiencies have a great effect on water projects. For example, a change from 50% to 60% farm irrigation efficiency would result in a 17% reduction in water requirement for the area or a 20% increase in the area which sould be served. This does not take into account any downstream reuse of return flow, but it points out that in some areas improved efficience of use of present water supplies may be more attractive in terms of costs and benefits than development of new supplies.
W70-01562

**FACTORS AFFECTING THE ABILITY OF AGRICULTURE TO PAY IRRIGATION-WATER COSTS,**
Food and Agriculture Organization of the United Nations, Rome (Italy).
M. A. Hagood.
In Isotope and Radiation Techniques in Soil Physics and Irrigation Studies, p 423-7, (Proc Symp, Istanbul, June 12-16, 1967), Intern at Energy Agency, Vienna 1967. 6 fig, 11 ref.
Identifiers: *Agriculture, *Water utilization, Land utilization, Water costs estimate.

There are no universally acceptable standard criteria for determining how much agriculture can pay for irrigation water. Justification of cost will depend upon the countrys need to develop its soil and water resources for food, for international trade, and for its cumulative effect on other industries in comparison with other possible uses and their overall contributions to the economy. Social and political conditions often have as much or more influence on development cost decisions than do strictly economic analyses. Many studies indicate that 10 cents/1000 gal is an upper limit of acceptable costs for developing irrigation water at present economic levels. Under private development and on projects where water users must pay total water costs, methods are available for making feasibility budgets based on present prices. Because of inflation, world food shortage, recessions, future population and other unknown factors, it is hazardous to predict how much farmers or agriculture can pay for irrigation water. Better utilization of water available now offers opportunities for developing sources at costs much less than those for sources such as seawater conversion.
W70-01563

**SOIL AND WATER CONSERVATION.**
For primary bibliographic entry see Field 04D.
W70-01602

# 04. WATER QUANTITY MANAGEMENT AND CONTROL

## 4A. Control of Water on the Surface

**FLOOD PLAIN INFORMATION, GLACIER CREEK, GIRDWOOD, ALASKA.**
Army Corps of Engineers, Anchorage, Alaska.

Corps Eng Flood Plain Rep, Aug 1969. 28 p, 6 fig, 10 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Girdwood (Alaska), Standard project flood, Intermediate regional flood.

Flooding of Glacier Creek, Girdwood, Alaska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01249

**FLOOD PLAIN INFORMATION, KAAAWA, OAHU, HAWAII.**
Corps of Engineers, Honolulu, Hawaii.

Corps Eng Flood Plain Rep, Aug 1969. 25 p, 7 fig, 9 plate.

Descriptors: *Floods, *Flood damage, *Hawaii, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Kaaawa (Hawaii), Standard project flood, Intermediate regional flood.

Flooding of Kaaawa, Oahu, Hawaii is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01251

**FLOOD PLAIN INFORMATION, MORGANTON, NORTH CAROLINA: VOLUME 1. HUNTING CREEK AND TRIBUTARIES.**
Corps of Engineers, Charleston, S.C.

Corps Eng Flood Plain Rep, July 1969. 57 p, 18 fig, 11 plate, 17 tab.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Flood control, Nonstructural alternatives, Maximum probable flood, Historic flood.
Identifiers: Morganton (NC), Standard project flood, Intermediate regional flood.

Flooding of Hunting Creek, Morganton, North Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01252

**STUDIES OF THE INTERNAL DRAINAGE OF GLACIERS,**
Uppsala Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02C.
W70-01255

**GEOPHYSICAL STUDIES OF WATER LEAKAGES FROM RESERVOIRS,**
Moscow State Univ. (USSR). Dept. of Geology.
A. A. Ogilvy, M. A. Ayed, and V. A. Bogoslovsky.
Pap presented at 13th Meeting of European Ass of Explor Geophysicists, Salzburg, June 1968. Geophysical Prospecting, Vol 17, No 1, p 36-62, Mar 1969. 27 p, 10 fig, 7 ref.

Descriptors: *Water loss, *Reservoir leakage, *Geophysics, Ice, Boreholes, Electrical equipment, Sands, Electrolytes, Water temperature, Resistivity, Currents (Water), Filtration, Dams, Damsites, Mathematical studies, Porosity, Electrical studies.
Identifiers: *USSR, Armenia, Uzbekistan.

Because geophysical methods offer good prospects for the indentification of leakage from water reservoirs, laboratory studies and observations at reservoir sites located in Armenia and Uzbekistan, USSR, were conducted. The electrical prospecting method for leakage detection is based on the possibility of using natural currents which form electric fields in passing through porous media. Observations at reservoir sites were made by moving nonpolarizable potential electrodes and water velocity measuring devices. The combination of natural

current method and benthonic flow rate measurements is effective in determining water leakage from reservoirs. In some cases it is useful to supplement these methods by temperature measurements within the whole reservoir profile. (Gabriel-USGS)
W70-01257

**COMBINED WEATHER AND VEGETATION MODIFICATION PROMISES SYNERGISTIC STREAMFLOW RESPONSE,**
Washington State Univ., Pullman. Coll. of Agriculture.
For primary bibliographic entry see Field 03B.
W70-01264

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01301

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01302

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01303

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 8-9, p 33-38, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Alteration of flow, *Riparian rights, *Reasonable use, *Indirect benefits, Natural flow doctrine, Riparian land, Water rights, Competing uses, Relative rights, Benefits, Public benefits, Prior appropriation, Legal aspects, Riparian land.
Identifiers: Non-riparian benefits, Harmful use.

Proposed section 429-1 would allow a riparian owner who has the privilege of effecting a harmful alteration of a waterbody under section k to affect the alteration to further the use of non-riparian land instead, as long as it was no more harmful than for the use of riparian land. This section would aid in the optimum development of land and water resources, while protecting the rights of co-riparians. This addition is needed to counter the common law rule that any use on non-riparian land that is harmful to riparians is unlawful. Constitutional attacks suggesting that the section destroys the cause of action a riparian has against a non-riparian user are not substantial since the harm would be limited to that allowed for riparian use. In effect, the risk of harm would not be increased over that previously allowed for harmless uses. (Douberley-Florida)
W70-01304

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01305

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01306

**STATE PARTICIPATION IN FEDERAL NAVIGATION AND FLOOD CONTROL PROJECTS.**

R I Gen Laws Ann secs 46-2-1, 46-2-2, 46-2-7 thru 46-2-9, 46-2-12, 46-2-13, 46-2-19 (1956).

Descriptors: *Rhode Island, *Flood control, *Administrative agencies, Navigation, Federal government, State governments, Government finance, Contracts, Eminent domain, Condemnation, Damages, Compensation, Cities, Relocation, Riparian rights, Political aspects, Legislation, Local governments, Legal aspects.
Identifiers: Grants of power.

The Director of Public Works may apply to Congress for federal funds for state harbor improvements. The director, cities, and towns may negotiate and enter into agreements with the federal government for participation in federal navigation and flood control projects. Agreements must be approved by the governor. Pursuant to such projects, cities and town may: (1) acquire by condemnation any land, easements, and rights-of-way required; (2) expend funds for such improvements and acquisitions; and (3) issue bonds to fund such projects. Cities and towns voting to cooperate with the state and federal government in flood control projects may acquire land and rights by eminent domain and may construct or relocate highways, bridges, sewers, power and communication lines, railroad tracks, dams, and pumping stations as necessary. Damages to the rights of riparian owners for tidewater land taken under this act must be awarded as for any other property right. (McDonough-Florida)
W70-01326

**DRAINAGE--CONDEMNATION FOR DRAINAGE SYSTEMS.**

Va Code Ann sec 15.1-283 (1964).

Descriptors: *Virginia, *Drainage systems, *Local governments, *Eminent domain, Drainage, Drainage program, Buildings, Structures, Appropriation, Costs, Public health, Public benefits, Public utilities.

The governing body of any county, city, or town shall have power to provide for adequate drainage of all areas in the county, city, or town. It may install and maintain drainage systems, acquire lands, buildings, structures, or any interest therein, and appropriate money therefor. Such governing body is vested with the power of eminent domain to the extent necessary for such acquisitions. (Smith-Florida)
W70-01332

**SUBDIVISION ORDINANCES FOR DRAINAGE AND FLOOD CONTROL.**
Va Code Ann sec 15.1-466 (1964).

Descriptors: *Virginia, *Drainage systems, *Flood control, *Sewers, Local governments, Drainage, Drainage programs, Regulation, Control, Management, Governments, Storms, Sanitary engineering, Legislation, Right-of-way, Light, Air, Public health, Public benefits, Public utilities, Cities.

A subdivision ordinance may include reasonable regulations and provisions that apply to: (1) plat details; (2) orderly development of the general area; (3) coordination of streets and drainage; (4) drainage and flood control, light and air, and other public purposes; (5) water, storm, sanitary sewer, and other utilities; (6) any right-of-way for public use, any street, curb, gutter, sidewalk, drainage or sewer system or other improvement. (Smith-Florida)
W70-01333

**DRAINAGE NETWORK ANALYSIS WITH K-BAND RADAR IMAGERY,**
Kentucky Univ., Lexington. Dept. of Geography.
For primary bibliographic entry see Field 07A.
W70-01427

**CONSERVANCY.**

Minn Stat secs 111.01 thru 111.82 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Drainage districts, *Drainage systems, *Flood control, Water levels, Vegetation, Drainage, Drainage programs, Water policy, Public health, Environmental sanitation, Water rights, Riparian rights, Costs, Control, Conservation, Governments, Water law, Legislation, Cities, Judicial decisions, Municipal water, Water control, Flood protection, Administrative agencies.

DRAINAGE, FLOOD CONTROL, AND THE CONTROL OF THE USE OF DRAINAGE SYSTEMS IN THE INTEREST OF SANITATION AND PUBLIC HEALTH ARE CLEARLY WITHIN THE FUNCTIONS OF GOVERNMENTAL ACTION. Therefore, the power is granted to the courts to grant petitions for the organization and establishment of districts for drainage and conservancy. Rights and duties of involved landowners are outlined, including provisions for the payment of costs and expenses of such district. Procedural requirements for organizing districts are established, and a board of directors is given the powers necessary to carry out the district's functions. Owners of land abutting upon any body of water are given the power to initiate proceedings to establish a uniform water level, persuant to outlined procedures. Municipalities are given the power to take steps necessary to control or destroy harmful or undesirable aquatic vegetation or organisms in public waters. The policy of the state is declared to be to promote the retention and conservation of all precipitated water in the area in which such precipitation falls. (Smith-Florida)
W70-01585

**CONSERVANCY.**
Minn Stat secs 111.01-111.20 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Drainage districts, *Reclamation, *Flood control, Drainage programs, Drainage, Water policy, Public health, Environmental sanitation, Water rights, Riparian rights, Costs, Control, Conservation, Governments, Water law, Legislation, Cities, Judicial decisions, Municipal water, Water control, Flood protection, Regulation, Streams, Rivers, River training, Irrigation, Surveys, Reservoirs, Reservoir construction, Gages, Rain gages, Stream gages, Warning systems.

The district court of any county in this state is vested with jurisdiction to establish drainage and conservancy districts for the purpose of: (1) regulating watercourses and the flow of water by altering such watercourses; (2) reclaiming or otherwise protecting lands subject to overflow; (3) irrigation;

(4) prevention of fires; (5) control of flood waters; and (6) providing for sanitation and public health. A petition for the formation of such a district must be signed by at least twenty-five percent of the resident freeholders of the district. Upon the granting of a petition the court appoints a board of directors to determine the need for such a district. The board and its employees may enter upon any lands to make surveys and examinations. Upon the filing of a petition by the board of directors, the district court is empowered to effect the drainage, reclamation, irrigation, or protection of land by issuing the necessary orders and decrees. The board may petition for the creation of reservoirs, water-power plants to be financed by the issuance of bonds, and the temporary removal of bridges. The board may establish and maintain stream and rain gauges and a flood-warning service. (Smith-Florida)
W70-01586

**CONSERVANCY.**
Minn Stat secs 111.21-111.42 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Riparian rights, *Costs, *Permits, Domestic water, Municipal water, Cost sharing, Cost allocation, Cost-benefit ratio, Repairing, Maintenance, Drainage, Drainage systems, Drainage programs, Water policy, Flood control, Flood protection, Public health, Water rights, Control, Conservation, Governments, Legislation, Cities, Assessments, Usufructuary rights.

Landowners rights to the use of the waters of the district for any purpose shall continue as they existed at the time of the organization of the district. Where improvements made by the district make possible a greater or better use of the waters, the right to such greater use is the property of the district. Such rights may be leased or assigned in return for reasonable compensation. Parties desiring to use the waters of the district must make application to the board, and preference is given to domestic and municipal uses. Expenses are paid out of the general funds of the counties involved in proportion to the benefits received, and each county auditor in turn assesses the property benefited in proportion to the benefit received. The board of directors may levy upon the property benefited such sum as the court may authorize for upkeep and repair of the district. Districts already established may acquire the right to operate under this chapter. The board of directors has full control and authority over all contracts of the district. (Smith-Florida)
W70-01587

**CONSERVANCY.**
Minn Stat, secs 111.65-111.82 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Water levels, *Vegetation, *Appraisals, Taxes, Water policy, Public health, Environmental sanitation, Water rights, Riparian rights, Costs, Cost allocation, Cost sharing, Conservation, Legislation, Governments, Cities, Municipal water, Domestic water, Benefits, Damages, Control, Assessments.

A majority of the owners of property abutting upon any body of water may initiate proceedings to establish a uniform water level by filing a petition with the district court. Three resident freeholders must be appointed as appraisers to ascertain the damages and benefits that will result. The court may revise, correct, amend, or confirm assessments made by the appraisers, and the amount of benefits assessed against each tract of land is a first lien thereon. The governing body of any city or town may expend funds for the control or destruction of harmful or undesirable aquatic vegetation or organisms in public waters. Such governing body may levy a special tax for such purposes. (Smith-Florida)
W70-01588

**WATERS: SURFACE WATER DRAINAGE,**
Robin F. Worthington.
U Fla L Rev, vol 2, no 3, p 392-402, Fall 1949, 11 p, 75 ref.

Descriptors: *Legal aspects, *Florida, *Water, *Water law, Civil law, Water rights, Surface runoff, Surface waters, Flood control, Ditches, Flooding, Judicial decisions, Water balance, Routing, Drainage, Drainage systems, Watercourses, Artificial watercourses, Developed waters, Water resources, Natural streams, Non-perennial streams, Perennial streams, Drainage programs, Water policy, Watershed management, Watersheds (Basins).

The disposition and control of surface water between precipitation and collection within defined water courses is discussed. The use of non-surface water is generally governed by the reasonable use doctrine. However, the general law of surface waters is a combination of the reasonable use doctrine, the civil-law rule, which prohibits interference with the natural flow of surface water to the extent that the enjoyment of another's land is disturbed, and the common-enemy or common-law rule which treats water falling on land as a common enemy with which any proprietor has an unlimited and unrestricted legal right to deal as he pleases not withstanding harm resulting to his neighbors. Surface water is defined in Florida as water, regardless of its origin, that drains without any distinct or well-defined channel. A proprietor owns and has an absolute right to surface water on his land. No one may complain if ordinary flow injures his property. However, one may not cause more than normal flow to enter adjoining lands. Florida does not follow either of the traditional doctrines, but rather decides tort liability upon the facts of each case. (Darragh-Florida)
W70-01592

**SEA WALLS AND HIGHWAY PROTECTION.**
Miss Code Ann secs 8497 thru 8500 (1956).

Descriptors: *Mississippi, *Diversion structures, *Tidal waters, *Highways, Financing, Costs, Construction costs, Bulkheads, Breakwaters, Barriers, Check structures, Dikes, Roads, Road construction, Cost analysis, Culverts, Legislation, Legal aspects, Sluices, Floodgates, Storms, Federal government, Projects.

The term 'sea wall' includes filling behind the wall, culverts, sluiceways, flood gates, and any other construction work found necessary for the protection of the water from storms, caving banks, and overflow. Each county board of supervisors may erect and maintain seawalls, breakwaters, bulkheads, shore stabilization structures, causeways, bridges, breakwaters, or other necessary improvements to protect public roads which extend along beach or shore lines of tidewaters and which are exposed to damage by water driven ashore by storms. The boards may issue bonds to finance the construction of protective structures and for the improvement or strengthening of exposed roads and highways. The boards must make preliminary plans, specifications, and estimates of construction costs and obtain federal approval with regard to navigation questions before bonds may be issued. (Kelly-Florida)
W70-01601

**SCHROEDER V ZIEGELMAN (RIGHT TO USE OF CANAL ON ANOTHER'S PROPERTY).**
443 SW2d 16-19 (Ct App Mo 1969).

Descriptors: *Canal construction, *Excavation, *Missouri, *Relative rights, Canals, Conveyance structures, Judicial decisions, Water rights, Lakes, Lake shores, Inlets (Waterways), Land use, Land tenure, Usufructuary right, Legal aspects.

Plaintiff dug a canal extending inland from the water line of a lake across the property of a third party. Defendant, who had no interest in the canal property, filled in the excavation and stated that he would do so again if it were reopened. Plaintiff petitioned for an injunction prohibiting defendant from interfering with plaintiff's re-opening, maintaining, and using the canal. The trial court denied the injunction. On appeal, the court held that since plaintiff had dug the canal and had occupied and taken possession of the land, the injunction was proper. As against a mere tortfeasor, actual possession of land was alone sufficient to maintain an action in trespass, even though plaintiff was without title and had secured his possession originally without the consent of the title holder. That plaintiff may have violated rights of the title holder was immaterial as between the parties to the action. (Douberley-Florida)
W70-01606

**THE NAVIGATION SERVITUDE,**
John P. Turner.
Title News, Vol 48, No 1, p 42-49, Jan 1969. 8 p, 23 ref.

Descriptors: *Navigation, *Federal government, *Legislation, *Riparian rights, Navigable waters, United States, Legal aspects, Judicial decisions, Water law, Water policy, Condemnation, Riparian land, Structures, Landfills, Jurisdiction, Ownership of beds, Bays, Lakes, Rivers, High water mark, Streams, Low water mark, Dams, Mississippi River, Federal jurisdiction.
Identifiers: *Navigation servitude, Title insurance.

The problems encountered by title insurers in dealing with the navigation servitude are pointed out and the need for corrective legislation is examined. The term 'navigation servitude' is used to describe the fact that the federal government can take property lying within the boundaries of a navigable water body for purposes of navigation without compensating the property owner for the taking. While many aspects of the law concerning the navigation servitude are discussed, two are emphasized: (1) the navigation servitude extends to the ordinary high water mark of navigable streams and may be maintained at that level by artificial means; and (2) within that boundary line, title to all property is defeasible without compensation as against the exercise of the navigation power. The foregoing aspects of the law are examined as possible pitfalls for the insurer. The history of attempts to formulate legislation to meet insurer's problems in this area is discussed. Legislation being formulated by a subcommittee of the American Bar Association is examined from the insurers' viewpoint. The legislation would: (1) make government approval for fill areas act as an estoppel to the navigation servitude; and (2) make government permit issuance for structures act as an estoppel. (Keith-Florida)
W70-01612

**LOCAL FLOOD PREVENTION AND WATER SUPPLY.**

Va Code Ann secs 15.1-31, 15.1-37, 15.1-37.2 (1964), as amended, (Supp 1968).

Descriptors: *Virginia, *Dam construction, *Local governments, *Flood control, Construction, Dams, Levees, Sea walls, Riparian rights, Compensation, Governments, Public benefits, Legislation, Agriculture, Domestic water, Industrial water, Water sources, Water supply.

Any county, city, or town may construct a dam, levee, sea wall, or other structure, or perform dredging operations to prevent the flooding or inundation of such county, city, or town. No suit at law or equity shall be brought because of such construction or operations except when based on a written contract. This section does not authorize the taking of private property without just compensation. The governing body of every county and town is authorized to: make expenditures in order to acquire land, participate in the construction of dams, and perform all other acts necessary to provide public water for agricultural, residential,

governmental, and industrial development of the county or town. (Smith-Florida)
W70-01621

**DAMAGES FROM MILLDAMS.**
R I Gen Laws Ann secs 46-18-1 thru 46-18-3, 46-18-10, 46-18-16 (1956).

Descriptors: *Rhode Island, *Damages, *Milldams, *Overflow, Legislation, Legal aspects, Flood damage, Ponds, Dams, Mills, Water supply, Rivers, Streams, Natural streams, Relative rights, Obstruction to flow, Remedies, Usufructurary right, Water utilization.

When any person has set up any water mill or dam for the purpose of forming a pond to supply water to any mill on the stream whereon the dam is located, he may continue and improve the pond and maintain the dam on his own land for his advantage without molestations. Any person aggrieved or injured by the maintenance of such a dam may commence an action against the dam owner in the superior court of the county where the dam is located. The mill and milldam complained of, together with the land on which they are situated, may be used to satisfy a judgment against the dam owner. In such actions the amount of damages against the dam owner, if any, will be decided by the jury unless otherwise agreed by the parties. No person owning a dam or any river or stream shall detain the natural stream thereof at any one time for more than twelve out of twenty-four hours when he has been requested by a dam owner within one mile below on the same stream to permit the natural stream to pass the lower dam. (Keith-Florida)
W70-01628

**INSPECTION OF DAMS AND RESERVOIRS.**
R I Gen Laws Ann secs 46-19-1 thru 46-19-5 (1956).

Descriptors: *Rhode Island, *Dams, *Reservoirs, *Supervisory control (Power), Safety, Legislation, Legal aspects, Inspection, On-site investigations, Surveys, Construction, Dam construction, Harbors, Rivers, Bridges, Repairing, Flood protection, Administrative agencies, Regulation.
Identifiers: *Public safety, Injunctions (Mandatory).

The Director of Public Works sees that a thorough inspection of every dam and reservoir in the state is made as often as is necessary to keep himself informed of the condition thereof. Every person who owns or controls a dam or reservoir is to furnish the Director, on written request, as comprehensive a description of such dam or reservoir as practicable, and make all surveys, plans, and drawings thereof as may be required by the Director. No dam or reservoir is to be constructed or substantially altered until plans and specifications of the proposed work have been filed with and approved by the Director. The Chief of the Division of Harbors and Rivers, when application is made by specified parties, or when he has cause to apprehend that any dam or reservoir is unsafe, sees that such dam or reservoir is viewed and thoroughly examined. If the Chief considers the dam or reservoir unsafe, he may order the owner thereof to lower the water level and take such other remedial steps as are necessary. If an owner fails to comply with such an order, the attorney-general may seek injunctive relief as prescribed. (Keith-Florida)
W70-01629

**HIGHWAYS: DRAINAGE OF SURFACE WATER.**

R I Gen Laws Ann secs 24-8-32, 24-8-33 (1956).

Descriptors: *Rhode Island, *Drainage systems, *Highways, *Obstruction to flow, Barriers, Diversion, Alteration of flow, Drainage programs, Drainage, Drainage water, Outlets, Sewers, Culverts, Administration, Administrative agencies, Legislation, State governments, Governments, Drainage systems, Surface water.

It is unlawful for any person to obstruct, block, or close any intake or outlet from any culvert, drain, or watercourse which has been placed and maintained under or within a state highway, without permission from the State Department of Public Works. It is also unlawful to make any connection into a state road drainage system or to drain or pump water onto a highway's travelled surface without permission. (Smith-Florida)
W70-01640

## 4B. Groundwater Management

**COMBINED USE OF SURFACE AND GROUND WATER FOR THE WATER SUPPLY TO BARCELONA (SPAIN),**
M. R. Llamas.
Bull Int Ass Sci Hydrol, Vol 14, No 3, p 119-136, Sept 1969. 18 p, 10 fig, 1 tab, 9 ref.

Descriptors: *Water supply, *Surface waters, *Groundwater, *Conjunctive use, Water quality, Aquifers, Water wells, Water pollution sources, Geology, Hydrogeology.
Identifiers: *Spain, *Barcelona.

The geological and hydrological characteristics of the groundwater reservoirs used for the Barcelona water supply are described. The connection between surface water and groundwater is emphasized. Groundwater meets about 50% of the current 360 mgd water demands for water supply to the Barcelona Metropolitan area. Present and future problems such as water pollution and water shortage, legal questions and education are discussed. The operational plan to solve or to avoid these problems is described. This plan includes combined use of surface and subsurface reservoirs for water conservation. (Knapp-USGS)
W70-01248

**WATER-QUALITY IMPROVEMENT BY GROUND-WATER RECHARGE,**
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 05D.
W70-01414

**THE EFFECT OF SEEPAGE LOSSES ON STREAM REGIMEN,**
Colorado State Univ., Fort Collins.
Donald D. DelManzo, Jr.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 30-34, 1969. 5 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Hydrologic budget, *Surface-groundwater relationships, *Return flow, *Mathematical models, Model studies, Streamflow, Infiltration, Groundwater movement, Irrigation water, Recharge, Alluvial channels, Alluvium, Consumptive use, Runoff, Water storage.
Identifiers: *South Platte River, Kersey (Colo), Julesburg (Colo).

Analysis techniques have been formulated for estimating underground water movement in the form of return flows resulting from irrigation. These techniques are applied to irrigation and precipitation water in a mathematical model of a large-scale 'river-aquifer system,' which describes a valley containing a perennial stream underlain by alluvial, water-conducting deposits such that essentially unobstructed flow can occur between stream and aquifer. To substantiate the validity of the groundwater analysis procedures, a model was developed to mathematically describe the interrelationships in the South Platte. The principle of the model was to use known input data, assumptions, idealizations, and analysis to calculate an estimated surface outflow at the downstream gage. If the calculated outflow significantly replicated the recorded outflow, then the theoretical procedures would be verified. The following budgetary equation was used: calculated flow at Julesburg= flow at Kersey+ reservoir return flow+ irrigation return flow+ base return flow - diversions to storage - diversions to irrigation - change in channel storage. (Knapp-USGS)
W70-01419

**REVIEW OF METHODS FOR MEASURING AND PREDICTING SEEPAGE,**
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W70-01420

**FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,**
Idaho Univ., Moscow. Dept. of Civil Engineering; and Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
For primary bibliographic entry see Field 02G.
W70-01422

**SALT BALANCE AND CRITICAL DEPTHS OF GROUND WATERS OF THE PART OF THE VAKH VALLEY UNDER IRRIGATION FOR MANY YEARS (RUSSIAN),**
For primary bibliographic entry see Field 03F.
W70-01447

**DETERMINING PERENNIAL RECHARGE,**
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W70-01484

## 4C. Effects on Water of Man's Non-Water Activities

**APPLICATION OF STANFORD WATERSHED MODEL CONCEPTS TO PREDICT FLOOD PEAKS FOR SMALL DRAINAGE AREAS; HPR-1 (3): KYHPR-64-23,**
Lexington Dept. of Highways, Ky. Div. of Research.
K. D. Clarke.
Ky Dep Highways Res Rep, Jan 1968. 106 p, 36 fig, 16 tab, 23 ref. Available from Clearinghouse as PB 184 076, for $3 in paper copy, 65 cents in microfiche.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Flood forecasting, Rational formula, Routing, Mathematical models, Digital computers, Streamflow forecasting, Hydrographs, Hydrograph analysis, Simulation analysis, Water balance, Hydrologic budget.
Identifiers: *Stanford watershed model.

A study was made to achieve two principal objectives: (1) updating rainfall intensity-duration curves for the hydraulic design of culverts and (2) adaptation of the Stanford Watershed Model concept to small drainage basins in Kentucky. Total rainfall was equated to total runoff and losses throughout a span of years; the losses were then accounted for as evaporation, infiltration, and others. Ideally, all of the significant hydrological parameters may be deduced; then through direct measurements of some essential input descriptors and indirect estimates of others, the water-balance concept may be applied to other basins. (Knapp-USGS)
W70-01293

**SEIFERT V SOUND BEACH PROPERTY OWNERS ASS'N (WATER DAMAGE FROM IMPROVEMENTS ON ADJACENT PROPERTY).**

303 NYS2d 85-90 (Sup Ct 1969).

Descriptors: *New York, *Surface runoff, *Washouts, *Damages, Judicial decisions, Surface drainage, Channels, Land, Runoff, Cloudbursts, Drainage water, Overland flow, Rain water, Precipitation excess, Slopes, Soil erosion, Storm runoff, Floodwater, Floodways, Gullies, Erosion, Flood damage, Soil management.

Plaintiffs removed a large sand dune from the edge of their property but retained a low mound above an adjoining unimproved and sandy roadway. Defendant property owners association later removed several large sand dunes on property immediately adjacent to plaintiffs' property and opened up the roadway for vehicles. During a heavy rainstorm plaintiffs' land was damaged as heavy torrents of surface water rushed over the property from a channel created by removal of the dunes and the downhill grading of the improved roadway. Defendants were held liable for damages to the extent of restoring plaintiffs' eroded land and placing a protective barrier around the property. Removal of the sand dunes alone did not give rise to liability, but channeling the water onto plaintiffs' property by means of the newly improved roadway was held to be actionable. In opening the roadway, the defendant had an obligation to do so without creating a condition likely to cause damage to plaintiffs' property. That the surface waters would flow from the opened roadway onto plaintiffs' land should reasonably have been anticipated, and failure to take steps to prevent the damage constituted negligence. (Douberley-Florida)
W70-01607

**MAINTENANCE OF TOWN HIGHWAYS.**
R I Gen Laws Ann secs 24-5-16 thru 24-5-19, 24-5-23 (1956).

Descriptors: *Rhode Island, *Highways, *Artificial watercourses, *Bridges, Damages, Watercourses (Legal), Bodies of water, Surveys, Bridge construction, Ditches, Culverts, Local governments, Riparian rights, Legislation, Diversion.

No highway surveyor may cause any watercourse in any highway to be diverted so as to damage any person's land, house, store, shop, building, business, or occupation without the consent of the town council. Any person claiming such damage may complain to the town council. The council examines each claim and may direct the surveyor to alter said watercourse in such a manner as the council deems proper. Whenever any artificial watercourse is made under, through, or beside any previously existing highway, the proprietor of such watercourse must maintain all bridges and fences which are necessitated thereby. Whenever any highway is laid out over or beside any previously existing artificial watercourse, the town laying out such highway must maintain all necessary bridges and fences. Any owner of land adjoining any public highway may build bridges or culverts over ditches in such highway for the purpose of safe and convenient passage from his land to the highway. No such bridge or culvert may be disturbed except by order of the town council. (Smith-Florida)
W70-01639

## 4D. Watershed Protection

**PERMISSION TO CAPTURE FLOODWATERS.**
For primary bibliographic entry see Field 06E.
W70-01320

**SOIL AND WATER CONSERVATION.**
Miss Code Ann secs 4940, 4941, 4943, 4944, 4947, 4948 (Supp 1968).

Descriptors: *Mississippi, *Erosion control, *Soil management, *Administrative agencies, Legislation, Water conservation, Water policy, Water management (Applied), Water resources development, Conservation, Natural resources, Land management, Cost sharing, Erosion, Soil erosion, Contour farming, Demonstration farms, Land use, Soil conservation, Sediment control, Future planning (Projected), Projects, Project benefits, Project planning, Cost allocation, Cost-benefit ratio.

Provisions are made for the establishment of a state soil and water conservation committee, which is to aid commissioners of soil and water districts, to coordinate their activities, and to secure federal cooperation and assistance in soil and water conservation projects. Procedures for organizing a soil and water conservation district are set out, along with administrative powers and duties. Districts have the power: (1) to conduct soil and erosion research in cooperation with other federal and state agencies; (2) to conduct demonstration projects; (3) to carry out preventive and control measures, with the permission of landowners affected; (4) to give financial aid to individuals and to other agencies; (5) to make available material or equipment needed by landowners to aid in erosion control; (6) to construct or purchase necessary projects; (7) to develop a comprehensive erosion and resources plan; (8) to require cost-sharing by benefitted lands; and (9) to adopt water and land use regulations, subject to landowner approval by referendum. (Douberley-Florida)
W70-01602

**DEVELOPMENT, CONSERVATION AND USE OF WATER RESOURCES.**
For primary bibliographic entry see Field 06B.
W70-01619

# 05. WATER QUALITY MANAGEMENT AND PROTECTION

## 5A. Identification of Pollutants

**BEHAVIOR OF SURFACTANTS AND OTHER DETERGENT COMPONENTS IN WATER AND SOIL-WATER ENVIRONMENTS,**
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 05B.
W70-01291

**SAMPLING FOR WATER POLLUTION.**
For primary bibliographic entry see Field 05G.
W70-01312

**STUDIES ON THE LONGITUDINAL MIXING IN OPEN CHANNELS AND ITS EFFECT ON THE RATE OF THE B.O.D. REACTION IN AQUEOUS MEDIA (IN CZECH),**
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W70-01381

**NEUTRON INELASTIC SCATTERING STUDIES OF WATER AND IONIC SOLUTIONS,**
Union Carbide Corp., Tuxedo, N.Y.
For primary bibliographic entry see Field 03A.
W70-01403

**ATOMIC ABSORPTION AND FLAME EMISSION SPECTROSCOPY ABSTRACTS.**
For primary bibliographic entry see Field 02K.
W70-01434

**MICROELEMENTS IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE ASIATIC USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
G. S. Konovalov, A. A. Ivanova, and T. Kh. Kolesnikova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 112-123, 1967. Soviet Hydrology: Selected Papers No 5, p 533-542, 1967. 5 fig, 1 tab, 10 ref.

Descriptors: *Trace elements, *Suspended load, *Rivers, Elements (Chemical), Manganese, Copper, Cobalt, Water quality, Water chemistry, Geomorphology, Climates, Temperature, Permafrost, Watersheds (Basins), Pacific Ocean.
Identifiers: *USSR, East Siberian Seas, Kara Sea, Laptev Sea, Zinc.

The concentration of V, Mn, Co, Ni, Cu, Zn, Mo, Ag, Sn, and Pb in water and suspended matter of the rivers of the Asiatic USSR is low. This is closely associated with the characteristic physiographic features of the river basins such as: (1) severe climate; (2) low temperatures over most of the year; (3) large volume of water in rivers; and (4) permafrost in the east. The role of the migration of elements in the dissolved form increases in the rivers of the Asiatic USSR. The importance of dissolved elements increases from west to east in the Kara Sea, the Laptev, and East Siberian Seas, and in the Pacific Ocean. The proposed sequence of elements in various basins is rather stable, except for Zn which migrates more with suspended substances in the rivers of the Laptev Sea basin. (Carsten-USGS)
W70-01449

**CONTENT OF INDIVIDUAL GROUPS OF ORGANIC SUBSTANCES IN THE WATERS OF SOME SOVIET IVERS,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. D. Semenov, A. P. Pashanova, T. S. Kishkinova, and L. I. Nemtseva.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 171-177, 1967. Soviet Hydrology: Selected Papers No 5, p 549-554, 1967. 1 tab, 34 ref.

Descriptors: *Organic compounds, *Rivers, *Water quality, Organic matter, Amino acids, Proteins, Carbohydrates, Water properties, Humic acids.
Identifiers: *USSR, Nonvolatile organic substances, Organic carbon.

Data are presented on the composition of organic substances in several large rivers in the Soviet Union. The content of organic carbon in the river waters analyzed ranged from 1.9 to 14.9 mg/liter. The content of amino acids, proteins, and amines ranged from 0.04 to 0.025, 0.2 to 0.8, and 0.1 to 0.4 mg/liter, respectively. In terms of glucose carbon, free reducing sugars and complex carbohydrates amounted to 0.03-0.2 and 0.14-0.29 mg/liter. The humic acids varied broadly (5.5-450 mg C/liter). The total content of the mentioned groups amounted to 0.58-1.22 mg C/liter, that is 6-38% of the total content of nonvolatile organic substances determined from carbon. (Carstea-USGS)
W70-01450

**BROMINE AND IODINE CONTENT IN THE WATER OF THE MAJOR RIVERS OF THE USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
T. Kh. Kolesnikova, and G. S. Konovalov.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 70-84, 1967. Soviet Hydrology: Selected Papers No 5, p 509-519, 1967. 1 tab, 29 ref.

Descriptors: *Rivers, *Water chemistry, *Iodine radioisotopes, Watersheds (Basins), Soils, Arid climates, Analytical techniques, Water quality, Ions.
Identifiers: *USSR, Bromine.

The bromine and iodine contents of water samples collected simultaneously in 30 of the largest rivers of the USSR are determined. Considerable differences in the physiographic conditions of the basins of large rivers determine the uneven dis-

tribution of bromine and iodine in the river waters of the Soviet Union. Low bromine and iodine concentrations are characteristic for rivers located in the wet zone and strongly leached soils. Conversely, in regions with a warm climate, the bromine and iodine concentrations are high. (Carstea-USGS)
W70-01451

**VARIATION IN TIME OF THE ISOTOPIC COMPOSITION OF THE SULFUR OF SULFATE IONS IN THE WATERS OF THE DON AND VOLGA RIVERS,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
M. V. Veselovskiy, M. V. Bebeshko, S. A. Kozyrev, I. F. Polozhentsev, and V. S. Putentseva.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 129-136, 1967. Soviet Hydrology Selected Papers No 5, p 543-549, 1967. 3 fig, 2 tab, 5 ref.

Descriptors: *Sulfates, *Rivers, *Radioisotopes, Ions, Analytical techniques, Water chemistry, Water quality, Gaging stations.
Identifiers: *USSR, Volga River, Don River, Sulfur isotopes.

The S-32/S-34 ratios in water of the Lower Don River (gaging station at Aksay City) ranged from 22.07 to 22.16 from October 1960 through June 1962. In the Volga River at Volgograd the ratio ranged from 22.04 to 22.11 from November, 1960 through December 1961. An inverse relationship was observed between the S-32/S-34 values and content of sulfate ions in water. (Carstea-USGS)
W70-01452

**RARE AND DISPERSED ELEMENTS (MICROELEMENTS) IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE EUROPEAN USSR,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-01453

**COMPOSITION OF ORGANIC SUBSTANCES IN FLOOD WATERS FORMING IN SMALL CATCHMENTS OF THE ARID ZONE,**
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-01454

**IMPROVEMENTS IN AUTOMATIC SAMPLING EQUIPMENT USED TO DETERMINE EXTENT OF POLLUTION IN RUNOFF FROM AGRICULTURAL WATERSHEDS,**
Agricultural Research Service, Washington, D.C.
W. M. Edwards, W. W. Bentz, and L. L. Harrold.
US Department of Agriculture, Agricultural Research Service ARS 41-151, ARS 41-151, p 1-16, May 1969. 16 p, 3 fig, 10 photo, 2 chart.

Descriptors: *Runoff, *Water pollution sources, Watersheds (Basins), Pollutant identification, Hydraulic equipment.
Identifiers: *Water pollution determination equipment.

Great care must be exercised in collecting, preparing, and storing runoff samples to be used in studying the loss of pesticides and other chemicals from agricultural lands. Several individual samples must be collected at variable predetermined time intervals throughout the runoff hydrograph of each storm. Each sample must be related to runoff rate at the time of sampling. A detailed description is presented of the construction and operation of automatic sampling equipment installed on experimental watersheds at Coshocton, Ohio. The equipment is designed to operate unattended. It remains on a standby basis and initiates a predetermined sampling sequence at the onset of runoff from the watershed. Samples are collected in 1-gallon glass jugs, which are stored in a refrigerator. The sampling mechanism turns itself off after the total number of samples is collected or if runoff stops before this. This composition of samples collected by the automatic equipment compares very favorable with that of samples collected by hand from below the flume. (National Agricultural Library)
W70-01478

**RADIONUCLIDE DISTRIBUTION IN PACIFIC SALMON,**
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W70-01577

## 5B. Sources of Pollution

**THE USE OF TRACERS TO INVESTIGATE THE RELATIONSHIP BETWEEN MINING SUBSIDENCE AND GROUNDWATER OCCURRENCE AT ABERFAN, SOUTH WALES,**
Institute of Geological Sciences, London (England). Dept. of Hydrogeology; and National Coal Board, Ystrad Mynach (Wales).
For primary bibliographic entry see Field 02F.
W70-01268

**BEHAVIOR OF SURFACTANTS AND OTHER DETERGENT COMPONENTS IN WATER AND SOIL-WATER ENVIRONMENTS,**
Geological Survey, Washington, D.C. Water Resources Div.
Cooper Wayman, H. L. Page, and J. B. Robertson.
Fed Housing Admin Tech Studies Publication No FHA 532, Feb 1965. 136 p, 104 fig, 22 tab, 283 ref.

Descriptors: *Surfactants, *Alkybenzene sulfonates, *Detergents, *Groundwater movement, *Water pollution, Infiltration, Analytical techniques, Soil contamination effects, Organic compounds, Dispersion, Sewage effluents, Biodegradation, Methodology.
Identifiers: *Detergent behavior (Water), *Soil-water environment, Anionic surfactants, Synthetic detergents.

This report is primarily concerned with alkylbenzene sulfonate (ABS), the anionic surface-active agent most frequently found in water supplies. The mechanisms and physical principles of detergent movement underground are discussed in a manner to provide background for engineering analysis of pollution problems. Unlike other organic wastes, ABS is not easily broken down by microorganisms, and it moves with sewage effluent, often into groundwater. ABS can be detected in low concentrations and thus used to trace the pollution. The report provides a good technical basis for understanding detergent movement underground; it does not constitute an FHA standard. (Lang-USGS)
W70-01291

**IMPOUNDING RESERVOIRS ON RIVERS, THEIR SIGNIFICANCE FOR THE DISPOSAL OF SEWAGE AND THEIR RELATION TO SECONDARY CONTAMINATION (IN CZECH),**
Institute of Hygiene, Prague (Czechoslovakia).
For primary bibliographic entry see Field 05C.
W70-01382

**TURBULENT BUOYANT CONVECTION FROM A SOURCE IN A CONFINED REGION,**
Cambridge Univ. (England). Dept. of Applied Mathematics.
For primary bibliographic entry see Field 08B.
W70-01390

**TIME-OF-TRAVEL STUDY - MOHAWK RIVER, ROME, NEW YORK TO COHOES, NEW YORK,**
Geological Survey, Albany, N.Y.
Harold L. Shindel.
NY State Water Resources Comm Rep of Invest RI-6, 1969. 48 p, 14 fig, 6 tab, 11 ref, 2 append.

Descriptors: *Fluorescence, *Dye releases, *Pollutants, *Velocity, *New York, Channel flow, Hydroelectric plants, Duration curves, Dams, Canals.
Identifiers: *Dye tracing, *Time of travel, Natural purification, Sanitation, Mohawk River, Erie (Barge) Canal.

Flow rate was determined for the 119-mile reach of Mohawk River from Gate 6, Rome, N.Y. to Crescent Dam, Cohoes, N.Y. Large quantities of municipal and industrial effluents are discharged into this reach. A 40% Rhodamine B dye solution was used for traveltime studies during periods of low flow (summer 1966) and high flow (spring 1967). The cumulative time-of-travel for all subreaches was 840 hours for low flows and 210 hours for high flows. Graphs are presented showing magnitude and frequency of discharge and the relationship between traveltime and discharge by subreaches. Based on shape and use, each subreach was classified into one of three types of channel sections: (1) natural river, (2) river-canal, or (3) the power-pool section. The natural river sections include 39.1 mi of the study reach, characterized by shallow cross sections and widening channels, where the traveltime is least. In the 58.9 mi of river-canal, the channel is straightened, dredged, and dammed for canal traffic. Traveltime through the power pools is controlled by the two distinct periods of high and low flow during the canal operation season. (Lang-USGS)
W70-01404

**MINAMATA DISEASE AND WATER POLLUTION BY INDUSTRIAL WASTE,**
Tokyo Univ. (Japan).
Jun Ui.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 37-44, 1969. 1 fig, 5 ref.

Descriptors: *Industrial waste, *Public health, *Water pollution, Industrial plants, Waste water disposal.
Identifiers: *Acetaldehyde synthesis, *Minamata disease, *Organomercuric compound, Chemical industry, Japan.

The author demonstrates the presence of an organomercuric compound in the waste water from the Minamata Factory. The organomercuric compound is a degradation product of a catalyst used in the manufacture of acetaldehyde. The waste water containing the organomercuric compound is discharged to the sea. The author claims that this discharge causes Minamata disease; the factory denies this. (Tyner-Washington)
W70-01465

**FORMALIZED THEORY OF THE DIFFUSION OF CHEMICAL PRODUCTS IN THE SEA (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, and N. Desirotte.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 125-156, 1969. 13 fig, 2 tab, 8 ref.

Descriptors: *Diffusion, *Mathematical models, *Path of pollutants, *Water pollution, Biodegradation, Dispersion.
Identifiers: *Zones of pollution, Long-term effects, Short-term effects.

The authors establish mathematical models for calculating approximate zones of pollution resulting from transitory and continuous emissions of waste water containing toxic chemicals. They then give an example of the application of their method. (Tyner-Washington)
W70-01469

**EFFECTS OF 'TORREY CANYON' TYPE POLLUTION ON THE UNICELLULAR MARINE**

**ALGA PHAEODACTYLUM TRICORNUTUM (FRENCH),**
Laboratoire de Physiologie Generale et Comparee du Museum, Paris (France); and Laboratoire de Physiologie des Etres Marins de l'Institut Oceanographique, Paris (France).
For primary bibliographic entry see Field 05C.
W70-01470

**APPEARANCE OF RED WATER CAUSED BY COCHLODINIUM SP. IN THE BAY OF JUAN-LES-PINS (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
For primary bibliographic entry see Field 05C.
W70-01472

**IMPROVEMENTS IN AUTOMATIC SAMPLING EQUIPMENT USED TO DETERMINE EXTENT OF POLLUTION IN RUNOFF FROM AGRICULTURAL WATERSHEDS,**
Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 05A.
W70-01478

**NATURAL CONTAMINATION HAZARDS IN ARID BASINS,**
Geological Survey, Washington, D.C.
J. H. Feth.
In: Groundwater Development in Arid Basins - Symposium, Utah State University, 1967, Proceedings. Utah State University, Logan, p 21-35, 1967. 15 p, 4 fig, 1 tab, 27 ref.

Descriptors: *Arid lands, *Great Basin, *Water quality, *Salinity, *Water pollution, Groundwater, Atmosphere, Brines, Phreatophytes, Dissolved solids, Aquifers.
Identifiers: *Natural contamination sources, Lithosphere.

Examples of contamination by naturally occuring chemical substances in the Great Basin area are discussed. The patterns appear to be similar to those in Arizona, New Mexico and Texas. They were comparable to conditions known in Australia, the Sahara, the Middle East and other arid or semiarid regions. Sources of contamination in the atmosphere, lithosphere, hydrosphere and biosphere as well as chemical characteristics of various contaminated waters were also discussed. Since the Great Basin has been without exterior drainage as far back as the Pleistocene, the amount of potable water of good quality that does occur raises questions which are largely unanswered. (Crouse-Arizona)
W70-01485

**RELEASE OF DISSOLVED ORGANIC MATTER BY MARINE SEAWEEDS AND DISTRIBUTION OF THEIR TOTAL ORGANIC PRODUCTION TO INSHORE COMMUNITIES,**
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
K. M. Khailov, and Z. P. Burlakova.
Limnology and Oceanography, Vol 14, No 2, p 521-527, 1969. 2 fig, 5 tab, 15 ref.

Descriptors: *Organic matter, *Marine plants, *Distribution, *Productivity, Phaeophyta, Rhodophyta, Chlorophyta, Decomposing organic matter, Herbivores, Ecology, Biomass, Ultraviolet radiation, Spectrophotometry, Solar radiation, Temperature, Kinetics, Photosynthesis, Littoral, Synthesis, Seasonal, Respiration, Detritus, Eutrophication, Water pollution sources.
Identifiers: *Release rates, *Inshore communities, Barents Sea, Black Sea, Dasya, Macrophytes, Fucus, Ascophillum, Laminaria, Rhodimenia, Cystoseira, Enteromorpha, Polysiphonia, Cladophora, Callithamnion, Dilophus, Ceramium, Laurencia, Cladostephus, Trophodynamics, Metabolites.

Release rates are estimated of organic matter for macrophytes, five species from Barents Sea and thirteen from Black Sea, under controlled experimental conditions. Rates (in milligrams organic matter/gram (dry weight) of plant per hour) for Barents Sea species varied between 0.9 and 2.9 weight of plants/hour in March; between 1.7 and 9.8 in June. For species from the Black Sea, rates were in range of 1.25 to 6.1 in fast growing plants and 0.5 to 1.6 in slowly growing plants. Total dissolved organic matter released per year have been calculated to be about 39% of gross production in brown algae; about 38% in red algae; and about 23% in green algae. Remainder or organic matter, approximately 30%, was released during decomposition of that part of standing stock not consumed by herbivorous animals. Thus, the total flow of dissolved organic matter from seaweeds during growth and after death may be as much as 70% of their gross production. Ecological significance is discussed of external organic metabolites released to the hydrosphere. (Jones-Wisconsin)
W70-01576

**RADIONUCLIDE DISTRIBUTION IN PACIFIC SALMON,**
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
C. E. Jenkins.
Health Physics, Vol 17, p 507-512, 1969. 2 tab, 23 ref.

Descriptors: *Radioecology, *Salmon, *Pacific Ocean, *Radioisotopes, Gamma rays, Manganese, Cobalt radioisotopes, Alaska, Oregon, Washington, Cesium, Columbia River, Nuclear explosions, Radium radioisotopes, Sodium, Potassium radioisotopes, Iron, Zinc radioisotopes, Sea water, Tracers, Phytoplankton, Food chains, X-rays, Spectrometry, Lead radioisotopes, Analytical techniques, Neutron activation analysis, Effluents, Migration patterns, Fresh water, Fallout, Water pollution sources.
Identifiers: Muscle, Nuclear tests, Scandium radioisotopes, Chromium radioisotopes, Yttrium radioisotopes, Silver radioisotopes, Barium radioisotopes, Europium radioisotopes, Mercury radioisotopes, Tellurium radioisotopes, Concentration factors, Eskimos, Liver, Bone, Seward (Alas), Kenai (Alas), Alakanuk (Alas), Half-life, Thorium radioisotopes, Feeding pattern, Cosmic rays, Bering Sea, Latitudinal distribution, Health physics, Indians.

Because salmon comprises a major portion of diet of Eskimos and Indians living on the west coast of Alaska, author measured 17 gamma-emitting radionuclides in four species of Pacific salmon. Along a gradient from northwestern Alaska through southern Alaska, to the Oregon-Washington Coast, concentrations in salmon muscle tissue decreased by factors from 1.5 to 3 for manganese-54, and 4.5 to 12 for cobalt-60, while concentrations of cesium-137 decreased less pronouncedly (approximately 25%). The Columbia River, Chinese nuclear testing, and other parameters influenced distribution patters of other radionuclides. For manganese-54, cobalt-60, zinc-65, and silver-110m, concentrations were 10- to 100-fold higher in liver as compared with muscle tissue, indicating that the former might serve as a sensitive monitor for presence and approximate concentrations of radionuclides in muscle. Relatively high concentrations of naturally occurring radium-226 in Alaskan salmon, in association with higher levels of artificial radionuclides, are sufficient to cause native fish-eating populations to exceed their maximum permissible concentrations (MPC), where percentage MPC is based upon intakes of 600 grams salmon/day (using MPC/30 as recommended by the International Committee for Radiological Protection for non-occupationally exposed individuals). Author also measured sodium-22, potassium-40, scandium-46, chromium-51, cobalt-57, iron-57, iron-59, barium-140, europium-152, mercury-203, and tellurium-208. (Jones-Wisconsin)
W70-01577

## 5C. Effects of Pollution

**HYDROGRAPHY OF THE BALTIC DEEP BASINS III,**
Fishery Board of Sweden.
For primary bibliographic entry see Field 02L.
W70-01245

**IMPOUNDING RESERVOIRS ON RIVERS, THEIR SIGNIFICANCE FOR THE DISPOSAL OF SEWAGE AND THEIR RELATION TO SECONDARY CONTAMINATION (IN CZECH),**
Institute of Hygiene, Prague (Czechoslovakia).
J. Gabriel.
Summaries in English and Russian. Ceskoslovenska Hygiena, V 2-3, (1969) p 166-171.

Descriptors: *Reservoirs, *Water pollution effects, Erosion, *Thermal stratification, *Waste disposal, Water supply, Water quality, Environmental effects, Biochemical oxygen demand, Dissolved oxygen, Organic compounds, Bacteria, Phytoplankton, Surface waters.

The results of comprehensive research on the reservoir Sedlice is presented. This research is focused on the problem of changes in the quality of running water after its impoundment. These changes in the quality of the water were substantially influenced by the 'accumulation factor.' The occurrence of thermal stratification is discussed. Utilizing five indicators (oxygen, organic substances, BOD-5, bacteriomass, phytobiomass) the author demonstrates the favourable effect of this accumulation factor on the quality of water in the reservoir which is connected with the river. By comparison of balance calculations of the accumulation of inflowing water contaminated with waste waters and accumulation without contamination, it was shown that according to some indicators (BOD-5, organic substances) the waste waters account only for 30 percent of the contamination, while surface run off accounts for 70 per cent. From the sanitary point of view, waste waters are not comparable with erosion materials from cultivated soil. Despite this fact it is necessary, with regard to raising the quality of the water in valley reservoirs, to seek effective means of eliminating this surface run off (danger of secondary 'self-contamination'). (novotny-Vanderbilt)
W70-01382

**RECHARGING CONSERVES NUCLEAR REACTOR COOLING WATER,**
Brookhaven National Lab., Upton, N.Y.
S. H. Wichman, and G. K. Ahlers.
Water and Wastes Engineering, p 79-81, Mar 1967. 4 fig.

Descriptors: *Cooling water, *Recharge, Lagoons, Radioactivity, Ground water.
Identifiers: Reactor-cooling.

A simple well water recycling system has cooled the medical research reactor at the Brookhaven laboratory for five years, without disturbing the natural ground water balance. The reactor is cooled, shielded and moderated by forced circulation of highly purified well water in a closed primary loop, which in turn is cooled by untreated well water. The two systems are never in contact. Additional heat from the dry graphite reflector is removed by forced draft filtered air. The used warm water is piped into one of the two recharge basins, consisting of ordinary precast drainage domes placed over perforated concrete slabs. Effective recharge area is about 1/4 acre. At maximum flow of 2600 gpm, the disposal rate is 0.25 gpm/ft sq, or percolation velocity of 0.4 in. per min. With the continuous disposal of the warm water, no measurable increase of the ground water temperature in the two wells at a distance of 1300 and 2100 feet from the basins has been found. A number of elaborate safeguards against leakage in the heat exchanger have been taken. With daily changeover of the basins, little maintenance is necessary. (Rietveld-Vanderbilt)
W70-01385

**THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS. 1. A GENERAL METHOD OF CALCULATION,**
Army Terrestrial Sciences Center, Hanover, N.H.
S. L. Dingman, W. F. Weeks, and Y. C. Yen.
CRREL, Research Report 206, Dec 1967. 35 p, 7 fig, 21 ref.

Descriptors: *Thermal pollution, *Ice, *Rivers, *Navigation.

An attempt is made to calculate the length of the ice-free reach which develops during the winter below a thermal pollution site on a river. A differential equation for the steady state heat balance of a volume element of a river is developed, which leads to the expression: x= (C sub x) the integral from (T sub wo) to (T sub wx) of (d (T SUB W)/Q (*)) where x is distance downstream from the pollution site to the cross section where the water temperature equals (T sub wx), (T sub wo) is water temperature at x equals zero, Q (*) is rate of heat loss from the water surface, and C sub x is a constant which includes flow velocity and depth. The value of x at T sub wx equals 0 deg C is taken as the length of the ice-free reach. Q (*) is the sum of the heat losses due to evaporation, convection, long and short wave radiation, and other processes, each of which is evaluated by an empirical or theoretical expression. The two principal limitations in accurately calculating downstream temperature changes are related to difficulties in evaluating the degree of lateral mixing in natural rivers and the convective and evaporative heat losses under unstable atmospheric conditions. Observations of lengths of ice-free reaches on the Mississippi River are in good agreement with the calculated values. Significant portions of the St. Lawrence Seaway can be kept ice-free by the installation of nuclear reactors at appropriate locations. (Upadhyaya-Vanderbilt)
W70-01392

**THE ZONE OF POLLUTIONAL EFFECTS (IN FRENCH),**
Belgrade Univ. (Yugoslavia).
S. Jankovic, and F. Edeline.
Tribune Du Cebedeau, 21 (1968), No 297-298, p 373-377.

Descriptors: *Water pollution effects, *Water pollution sources, *Pollutant identification, *Thermal pollution, Mixing, Water quality, Standards, Waste dilution, Waste disposal, Self-purification, Biochemical oxygen demand, Stratified flow, Dissolved oxygen, Stratification.

The definition of the size of the zone of pollution influence is stated according to the literature survey presented in the paper. The pollution and its influence is distinguished into 6 groups; (1) thermal pollution (calories), (2) dissolved solids, (3) colloids, (4) suspended solids, (5) sediments, and (6) solids reacting chemically with the aqueous environment. To determine the zone of influence, knowledge of hydraulic parameters is of importance. Two different approaches are mentioned; (1) Czechoslovakian definition--the zone of influence could be looked upon as the zone where exceeding a limit is tolerable, the dilution of pollutants is calculated as the dilution by the entire discharge, (2) Romanian definition--the zone of influence represents a factor of safety, the comparison of diluted pollutants to limits is carried out in a part of the stream, not in the entire cross section. The results of several studies found in the literature are presented and discussed. (Novotny-Vanderbilt)
W70-01395

**RECORD LOW DISSOLVED OXYGEN IN THE ISLAND AREA OF LAKE ERIE,**
Ohio State Univ., Columbus. Coll. of Biological Sciences; and Ohio State Univ., Dept. of Zoology and Entomology.
N. Wilson Britt, Edwin J. Skoch, and Kenneth R. Smith.
The Ohio J Sci, Vol 68, No 3, p 175-179, May 1968. 5 p, 1 fig, 12 ref.

Descriptors: *Lake Erie, *Lakes, *Dissolved oxygen, Sampling, Seasonal, Winter, Summer, Air temperature, Statistical methods, Wind velocity, Dissolved solids, Plant growth, Nutrients, Nitrogen, Phosphorus, Physicochemical properties, Weather patterns, Climates.
Identifiers: *Oxygen depletion (Lake Erie), Lakewater dissolved oxygen.

The dissolved oxygen content of Lake Erie was investigated by collecting daily samples from June 22 to August 31, 1966 at a single station south of Rattlesnake Island. Dissolved oxygen near the bottom fluctuates considerably from 0.1 ppm recorded on July 1 to 9.2 ppm on July 19. Two more low periods were recorded on August 7 (3.7 ppm) and August 30 (3.0 ppm). In each of these 2 cases, the low-oxygen condition was associated with an average wind speed of about 6 knots and air temperature of about 26 deg C. Statistical analysis indicates a significant relationship between wind speed and dissolved oxygen. (Gabriel-USGS)
W70-01425

**PRIMARY PRODUCTIVITY - PHYTOPLANKTON RELATIONSHIPS, HODGSON LAKE, PORTAGE COUNTY, OHIO,**
Kent State Univ., Ohio. Dept. of Biological Sciences.
John H. Olive, John H. Morrison, and Charles V. Riley.
The Ohio J Sci, Vol 68, No 3, p 152-160, May 1968. 9 p, 4 fig, 3 tab, 30 ref.

Descriptors: *Lakes, *Productivity, *Phytoplankton, *Ohio, Diatoms, Seasonal, Winter, Photosynthesis, Carbon, Organic matter, Biomass, Chlorophyll, Temperature, Ice, Chlorides, Oxygen, Silica, Phosphates, Iron, Light penetration.
Identifiers: Hodgson Lake (Ohio), Lake productivity.

Primary productivity-phytoplankton relationships were studied in 1963-1964 in Hodgson Lake, Ohio. The lake was found to be a 'blue-green-diatom' reservoir of moderate productivity, but containing a large phytoplankton standing crop. Average cell volumes varied from 1.4 cu mm per liter in September to about 88.6 cu mm per liter in June. Photosynthesis ranged from 4-5 mgC per sq m per day during the winter and about 2600-2700 mgC per sq m per day in June and October. (Gabriel-USGS)
W70-01426

**CHRONIC TOXICITY OF COPPER TO THE FATHEAD MINNOW (PIMEPHALES PROMELAS) IN SOFT WATER,**
Federal Water Pollution Control Administration, Cincinnati, Ohio. Newtown Fish Toxicology Lab.
Donald I. Mount, and Charles E. Stephan.
J Fish Res Bd Canada, Vol 26, No 9, p 2449-2457, 1969. 6 tab, 8 ref.

Descriptors: *Copper, *Hardness (Water), *Minnows, *Toxicity, Fish.
Identifiers: *Application factor, *Pimephales promelas, Toxicity bioassay, Chronic toxicity, 96-hr TLm.

The application factor is defined by the authors as the 'maximum acceptable toxicant concentration (MATC)' divided by the 96-hr TLm. They suggest the application factor as a means of determinimg safe concentrations of toxic pollutants. In this paper they determine that the MATC of copper for the fathead minnow (Pimephales promelas) in water having an EDTA hardness of 30 mg/liter (as CaCO3) is between 0.13 and 0.22 of the 96-hr TLm value. In an earlier study the application factor for copper in water with an EDTA hardness of 200 mg/liter (as CaCO3) was found to be between 0.03 and 0.08 for the same species. Various factors lead the authors to conclude that the experiments reported are not conclusive evidence that hardness does or does not affect the application factor for copper and fathead minnows. They suggest refinements which should increase the accuracy and precision of future determinations of application factors. (Tyner-Washington)
W70-01458

**EFFECTS OF THE TREATMENT OF AN OYSTER BED WITH POLYSTREAM AND SEVIN,**
Virginia Inst. of Marine Science, Gloucester Point.
Dexter Haven, Michael Castagna, Paul Chanley, Marvin Wass, and James Whitcomb.
Chesapeak Sci Vol 7, No 4, p 179-188, Dec 1966. 9 tab, 12 ref.

Descriptors: *Molluscasides, *Oysters, *Pest control, *Pesticides, *Snails, Mollusks, Benthic fauna.
Identifiers: *Crassostrea virginica, *Drills, *Polystream, *Sevin, *Urosalpinx cinerea, Hog Island Bay (Va).

A series of field tests near Wachapreague, Virginia, in 1963 evaluated Polystream and Sevin mixed with sand as a means of controlling populations of oyster drills, Urosalpinx cinerea. Tests were designed to evaluate effects on planted oysters, drills, drill egg case deposition, crabs, and benthic invertebrates. Application of the chemicals to planted oyster beds did not reduce drill populations or numbers of drill egg cases deposited. Oyster production was not increased and treatment had an adverse effect on most species of benthic macroinvertebrates. Absence of drill control could have been associated with mixing of treated sand into subsurface deposits but other factors may have been involved. (Tyner-Washington)
W70-01459

**SHORT-TERM EFFECTS OF 2,4-D ON AQUATIC ORGANISMS IN THE NAKWASINA RIVER WATERSHED SOUTHEASTERN ALASKA,**
Bureau of Commercial Fisheries, Auke Bay, Alaska.
Howard S. Sears, and William R. Meehan.
US Dept of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Biological Laboratory, Auke Bay, Alaska, Sept 1969. 24 p, 2 tab, 11 appended tables.

Descriptors: *Herbicides, *Trout, *Diptera, Aquatic animals, Aquatic insects.
Identifiers: *2-4-D, *Nakwasina River, *Vegetation control, Aerial spraying, Coho salmon fry, Plecoptera, Ephemeroptera, Dolly Varden trout.

The Forest Service sprayed 2,4-D on logged off land on Baranof Island to control Red alder at a rate of 2 lbs/acre. There was no significant immediate mortality to fish (Coho salmon and Dolly Varden) and aquatic insects even in streams that were sprayed directly. Water samples and fish tissue samples analyzed for 2,4-D content showed concentration levels below those considered lethal. (Katz-Washington)
W70-01460

**ECOLOGICAL MANAGEMENT PROBLEMS CAUSED BY HEATED WASTE WATER DISCHARGE INTO THE AQUATIC ENVIRONMENT,**
Virginia Polytechnic Inst., Blacksburg.
John Cairns, Jr.
The Governor's Conference on Thermal Pollution, July 18, 1969, Traverse City, Michigan. Published Aug 1969 Michigan Water Resources Commission, p 21-30, Aug 69. 21 ref.

Descriptors: *Water temperature, *Thermal pollution, Ecosystems, Fish physiology, Mortality, Thermal stress.
Identifiers: *Heated waste waters, *Physiological stress, *Heat death, Physiological aberrations.

A brief, general discussion of the effects of heated discharges upon the ecosystem and the presentation of four alternatives that would allow heated discharges without serious degradation of the ecosystem. (Katz-Washington)

W70-01461

**ORGANOCHLORINE PESTICIDES IN THE ENVIRONMENT,**
Bureau of Sport Fisheries and Wildlife, Laurel, Md. Patuxent Wildlife Research Center.
Lucille F. Stickel.
Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Special Scientific Report - Wildlife No 119, Oct 1969. 32 p, 3 tab, 210 ref.

Descriptors: *Pesticides, *Pesticide kinetics, *Pesticide toxicity, *Chlorinated hydrocarbon pesticides, Pesticide residues, Aquatic life.
Identifiers: *Residues-birds, *Field mortalities, *Population changes, *Physiology, *Reproductive changes, Residues - fish and shellfish.

A thoroughly and extensively documented review of the biological changes caused by chlorinated hydrocarbon pesticides. Author documents the residues found in wild animals, fish, shellfish, birds, including water birds. The kinetics of chlorinated hydrocarbon pesticides in the aquatic and terrestrial environment is described. Experimental studies of pesticide kinetics in the individual organisms including fish and shell fish are described and the results are presented. A list of some pesticide mortalities of fish and fish-eating birds is given. The changes in populations of fish, aquatic insects, and birds are described. The changes in the reproductive patterns of mammals, birds, and fish subjected to chlorinated hydrocarbons are described. The data on the changes in reproduction, especially that of fish-eating birds in relation to residues in eggs and adults, is presented. Research needs are also discussed. (Katz-Washington)
W70-01462

**THE BIOLOGICAL AND ECOLOGICAL EFFECTS OF ACID MINE DRAINAGE WITH PARTICULAR EMPHASIS TO THE WATERS OF THE APPALACHIAN REGION,**
Washington Univ., Seattle. Coll. of Fisheries.
Max Katz.
'Impact of Mine Drainage on Recreation and Stream Ecology', Appendix F, Ecology in Acid Mine Drainage in Appalachia, Appalachian Regional Commission, Washington, DC, June 1969. 65 p, 5 tab, 200 ref.

Descriptors: *Acid mine water, *Brook trout, *Appalachian Mountain Region, *Water pollution, *Toxicity, Eco system, Fish stocking effects, Water resources, *Acid streams, Birds, Mammals, Reptiles, Aquatic plants, Bioassays, Domestic wastes, Self purification, Fish reproduction.
Identifiers: *Fathead minnow, *pH, Dissolved iron, Fish growth, Benthos, Fishery management procedures.

An extensive review of the published world literature on the effects of acidic waters and acid mine drainage water on the receiving streams. Spawning of fish is inhibited below pH 7.0. Brook trout are more tolerant to low pH than rainbow trout and can tolerate pH below 5.0 and 6.0. The cause of death of fish held at low pH is due to acidemia. If food is sufficient, fish can grow well in water below pH 7.0. Acid waters can be reclaimed by adding lime. In acid lakes as the pH increases toward neutrality, the number of aquatic plants increases. Aquatic insects are limited by pH levels below 4.0. Purification of domestic wastes is inhibited in acid mine waters. A stocking program of trout will provide recreational fishing if the pH is maintained above 6.0. For non-trout species, the pH should be maintained at pH 6.5 or above, but stocking is not required. (Katz-Washington)
W70-01463

**MEDICAL ASPECTS OF MINAMATA DISEASE,**
Kumamoto Univ. (Japan).
Haruhiko Tokuomi.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 5-35, 1969. 13 fig, 6 tab, 11 ref.

Descriptors: *Epidemiology, *Industrial wastes, *Public health, *Water pollution, Heavy metals.
Identifiers: *Minamata disease, *Organic mercury poisoning, Japan.

The epidemiological, clinical and pathological features of the outbreak of Minamata disease in Minamata City in Kumamoto Prefecture, Kyushu, Japan, are reported. There is in the city a factory whose wastes discharged into the nearby waters contain mercury. The fish and shellfish taken in these waters contain high levels of mercury. (Tyner-Washington)
W70-01464

**STUDY OF THE TOXICITY OF CHEMICAL PRODUCTS WITH RESPECT TO THE MARINE FOOD CHAIN (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, R. Charra, and G. Malara.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 45-72, 1969. 14 fig, 7 tab, 7 ref.

Descriptors: *Detergents, *Insecticides, *Toxicity, *Water pollution, Food chains, Aquatic algae, Brine shrimp, Fish, Mussels.
Identifiers: *Hydrocarbon, *Toxicity threshold.

The threshold toxicities of 5 chemical pollutants (3 detergents, 1 insecticide, 1 hydrocarbon) were determined for organisms from 3 levels of the food chain (phytoplankton, zooplankton, fish). The results show that the toxicity of the chemicals varies from one organism to another and from one life stage to another in the same organism. (Tyner-Washington)
W70-01466

**STUDY OF THE BIODEGRADABILITY OF TOXIC CHEMICAL PRODUCTS WITH RESPECT TO THE MARINE FOOD CHAIN (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, and J. P. Gambarotta.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 73-105, 1969. 19 fig, 3 tab, 8 ref.

Descriptors: *Biodegradation, *Detergents, *Insecticides, *Marine bacteria, *Toxicity, *Water pollution, Aquatic algae, Brine shrimp, Fish, Food chains, Mussels.
Identifiers: *Hydrocarbon.

Test solutions of 5 chemical pollutants (3 detergents, 1 insecticide, 1 hydrocarbon) at concentrations twice the previously determined threshold doses for the organisms in question were subjected to degradation by marine microorganisms for 3, 6, or 9 days prior to the introduction of the test organisms. These organisms were drawn from different levels of the food chain; primary producers, 2 species of phytoplankton· herbivores, zooplankton and mussels; carnivores, fish. In some cases biological degradation of the chemical pollutant caused a reduction in toxicity. (Tyner-Washington)
W70-01467

**STUDY OF THE EFFECTS OF CHEMICAL POLLUTANTS ON PLANKTON: DEGRADABILITY OF FUEL BY SOIL AND MARINE MICROORGANISMS (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, J. Aubert, S. Daniel, and J. P. Gambarotta.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 107-123, 1969. 9 fig, 10 ref.

Descriptors: *Biodegradation, *Fuel, *Marine microorganisms, *Water pollution, Diatoms.
Identifiers: *Hydrocarbon, *Terrestrial microorganisms, Asterionella japonica.

The authors determined the threshold toxicity of a fuel oil on the marine diatom Asterionella japonica. They allowed marine microorganisms and terrestrial microorganisms from sewage to biodegrade the fuel oil and then they introduced cultures of the diatoms. The resulting growth curves showed the extent to which the microorganisms had detoxified the fuel oil. The authors estimate that the microorganisms in the marine environment can degrade approximately 200 grams of fuel oil per cubic meter per year. (Tyner-Washington)
W70-01468

**EFFECTS OF 'TORREY CANYON' TYPE POLLUTION ON THE UNICELLULAR MARINE ALGA PHAEODACTYLUM TRICORNUTUM (FRENCH),**
Laboratoire de Physiologie Generale et Comparee du Museum, Paris (France); and Laboratoire de Physiologie des Etres Marins de l'Institut Oceanographique, Paris (France).
J. C. Lacaze.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 157-179, 1969. 3 fig, 2 tab, 36 ref.

Descriptors: *Detergents, *Diatoms, *Oil, *Oil wastes, *Surfactants, *Water pollution, Cleaning, Disasters, Oily water, Marine algae, Ships.
Identifiers: *Crude oil, *Gamosol, *Oil spills, *Torrey Canyon, Aromatic solvents, Phaeodactylum tricornutum.

The author studied the effects of both crude oil (of the sort carried by the 'Torrey Canyon') and Gamosol (a detergent used to disperse oil) on Phaeodactylum tricornutum, a marine diatom. A 10% reduction in growth was observed in cultures prepared with 1% petroleum extracts. After aeration the reduction in growth was 5%, some toxic volatile compounds having been eliminated and the oxygen concentration increased. Petroleum extracts which had been previously raised to a temperature above 100 deg C exhibited an increased toxicity (35% reduction in growth). Gamosol (14% nonionic surfactants and 86% aromatic solvents) is more toxic (50% reduction in growth after exposure to 5.6 ppm) than the surface active fraction (50% reduction in growth after exposure to 8 ppm). However, this toxicity varies because of the high volatility of the solvent in dilute solution. A 30 minute exposure to 40 ppm Gamosol killed the cells. (Tyner-Washington)
W70-01470

**THE PROBLEM OF RED WATER (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
J. M. Pincemin.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 181-203, 1969. 3 fig, 61 ref.

Descriptors: *Dinoflagellates, *Red tide, Fishkill, Public health, Nutrients, Salinity, Water temperature.
Identifiers: *Causes of red water, *Red water.

The author through personal research and bibliographic study surveys the problem of red water. He begins by enumerating its characteristics: color, categories and numbers of individuals, localization, duration and toxicity. He then looks at the evolution of the process. The seawater is calm and has a temperature higher than the preceding days. The salinity is generally lower. The quantity of nutrients, though larger than usual, is not sufficient to explain the high rate of multiplication. The accumulation of organisms is therefore explained by accelerated multiplication in a thick layer of seawater followed by vertical concentration (positive phototaxis and reduced density of the organisms) and horizontal concentration by winds. The usual monospecificity is thought to be due to the complexity of the ecological needs of the species. (Tyner-Washington)
W70-01471

**APPEARANCE OF RED WATER CAUSED BY COCHLODINIUM SP. IN THE BAY OF JUAN-LES-PINS (FRENCH),**
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
J. M. Pincemin.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 205-216, 1969. 4 fig, 1 tab, 18 ref.

Descriptors: *Red tide, *Dinoflagellates, Salinity, Water temperature, Nutrient requirements.
Identifiers: *Red water, Causes of red water, Juan-les-Pins, *Cochlodinium sp.

An occurrence of red water containing 30 to 80 million Cochlodinium sp. cells per liter was reported during 4 days of June, 1968, in the Bay of Juan-les-Pins. The mass of seawater containing the organisms was of lower salinity and higher temperature than the surrounding water and had a larger concentration of nutrients. The high concentration of Dinoflagellates is explained by both vertical (positive phototaxis and reduced density) and horizontal (wind) concentration. Culture studies showed that Cochlodinium sp. has highly specialized requirements and that it inhibits Chaetoceros sp. (Tyner-Washington)
W70-01472

**LITERATURE REVIEW 1967 (TEMPERATURE).**

Journal of Water Pollution Control Federation, Vol 40, No 6, p 1021-1022, 1024-1033, June 1968. 14 ref.

Descriptors: *Temperature, *Fish, *Publications, *Fish behavior, Fish food organisms, *Reviews, Bibliographies.
Identifiers: Cold water discharge, Cold water salmonid streams, Warm water centrarchid environment.

The American literature of 1967 is surveyed on the effects of temperature on fish life. Main topics are acclimation of fish to different temperatures, including standards for temperature regulations for cold water salmonid streams, warm water centrarchid environments, and estuaries. One article is review on cold water discharge. (Rietveld-Vanderbilt)
W70-01474

**LITERATURE REVIEW, 1967, (THERMAL POLLUTION - BIOLOGICAL EFFECTS),**
C. C. Coutant.
Journal of Water Pollution Control Federation, Vol 40, No 6, p 1047-1052, June 1968. 37 ref.

Descriptors: *Thermal pollution, *Publications, *Fish behavior, *Aquatic life, Thermal power plants, Dissolved oxygen, *Reviews, Bibliographies.

This article reviews the literature of 1967 on the biological effects of thermal pollution. The main topics are the biological problems associated with nuclear power plants, water criteria to protect aquatic life, DO in streams in correlation with thermal pollution, influence of temperature on aquatic life, resistance of cells to high temperature; relationship of water temperature to growth of some fish, preference temperatures of some fish, constructive uses of waste heat from thermal power plants. (Rietveld-Vanderbilt)
W70-01475

**ENVIRONMENTAL FACTORS RELATING TO LARGE WATER PLANTS,**
Battelle Memorial Inst., Richland, Wash.
H. M. Parker.
Water Production Using Nuclear Energy (Ed by R G Post and R L Seale), p 209-26, 44 ref, Univ Arizona Press, Tucson (1966). (Proc Am Nucl Soc Symp, Mar 1966, Tucson).

Identifiers: *Reviews, *Site selection criteria, *Waste disposal, Algae control, Microorganism control, Saline contamination, Wastes, Water biology.

A state-of-the-art review on the effect of thermal and saline pollution from a large-scale nuclear dual-purpose plant on the marine life in the area around the plant site. Present regulations appear to cover the aspect of the release of radioactive material. However, restrictions on thermal and saline water release are not uniform. Temperature and salinity are two of the most potent physical factors in the life of marine and brackish water organisms, since they largely characterize the physicochemical properties of the medium. There is a complex correlation between the biological effects of temperature and salinity - temperature can modify the effects of salinity, and salinity can modify the effects of temperature. Changes in temperature and salinity alter the physical and chemical properties of water, and organisms react to the total environment. Therefore, detailed effects ascribed to temperature and salinity alone cannot be defined.
W70-01543

**AQUATIC WEEDS,**
Wisconsin Univ., Madison. Coll. of Agriculture; and Agricultural Research Service, Fort Lauderdale, Fla. Crops Research Div.
L. G. Holm, L. W. Weldon, and R. D. Blackburn.
Science, Vol 166, p 699-709, Nov 1969. 10 fig, 29 ref.

Descriptors: *Aquatic weeds, *Eutrophication, Lakes, Dams, Streams, Vegetation, Rivers, Drainage, Navigation, Water hyacinth, Vectors (Biology), Herbicides, Harbors, Irrigation, Hydroelectric plants, Diseases, Reservoirs, Evapotranspiration, Floods, Florida, Wisconsin, Alabama, Louisiana, Mississippi, Canals, Rice, Watershed management, Shellfish, Bulrush, Cattails, Alligatorweed, Phreatophytes, Cottonwoods, Mesquite, Biocontrol, Water pollution effects, Mechanical equipment, Mosquitoes, Snails, Tilapia.
Identifiers: *Resources management, Infestations, Pistia stratiotes, Eichhornia crassipes, Salvinia auriculata, Africa, Central America, South America, Asia, Australia, New Zealand, Lemnaceae, Cyperus papyrus, Hydrilla.

The supply of both water and soil are limited. Rampant growth of aquatic weeds is symptomatic of the failure to manage resources. Many water sources of Asia and Africa, and of Wisconsin and Florida, are so fertile and so well innoculated with aquatic weeds that they can no longer correct themselves. Using combinations of mechanical, biological (turning nature against itself), and chemical (selective herbicides) methods of control, we can help with the restoration of watercourses. The scourge of some major rivers in water hyacinth, now generally distributed in Africa, and in many lakes, streams, and reservoirs of Central and South America. Floating mats of water fern, with water lettuce, infest Lake Kariba, Africa. These mats serve as host sites for mosquito larvae. Submersed weeds invade waterways rapidly; emersed weeds are troublesome in irrigation and drainage systems, and Phreatophytes waste water of stream channels. Islands of large masses of floating dead aquatic vegetation are impossible to cope with in channels of main streams. Papyrus of African waterways, frequently mixed with a robust grass, is one of the principal plants forming these islands. (Jones-Wisconsin)
W70-01575

**NUTRIENT LIMITATION OF SUMMER PHYTOPLANKTON GROWTH IN CAYUGA LAKE,**
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02H.
W70-01579

**PHOSPHATE ADSORPTION AND ISOTOPIC EXCHANGE IN LAKE MUDS,**
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
For primary bibliographic entry see Field 02H.
W70-01581

**CAN ECOLOGY PROVIDE THE BASIS FOR SYNTHESIS,**
Wisconsin Univ., Madison. Lab. of Limnology.
For primary bibliographic entry see Field 06F.
W70-01582

**LIMNOLOGICAL EFFECTS OF FERTILIZING BARE LAKE, ALASKA,**
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-01583

**POLLUTION: A STUDY IN ECOSYSTEM PATHOLOGY,**
Federal Water Pollution Control Administration, Washington, D.C. Office of Estuarine Studies.
Harold Berkson.
Preprint of paper presented at meeting of the American Society of Limnology and Oceanography, June 17, 1968, Madison, Wisconsin. 9 p.

Descriptors: *Ecosystems, *Pollution abatement, Water pollution effects, Pesticides, Fishkills, Epidemics, Water pollution control, Eutrophication, Nutrients.
Identifiers: *Environmental quality, *Ecosystem pathology, *Environmental modifications, Nutrient balance, Biological magnification, Genetic alteration, Mercury contamination, Organic hydrocarbons, Minamata disease, Sphaerotilus natans, Nannochloris atomus.

Effects of pollution on aquatic organisms and their ecosystems range from the large scale, well publicized, disasters, such as massive fishkills, down to most subtle changes in the ecosystem. The author cites examples from four categories illustrating the range of pollution effects. (1) Change in the environment, such as additions of high concentrations of toxic substances, DDT for example; introduction of crude oil, and presence of excess silt, which give rise to familiar biological problems of pollution. (2) The environment may be altered by enhancing growth of undesirable organisms, such as Sphaerotilus natans (associated with carbohydrate-containing wastes), and Nannochlorus atomus whose growth is enhanced by nutrient imbalance. (3) 'Biological magnification' refers to substances which are toxic only after passing through a portion of the food chain or at a specific point in an organism's life. (4) Teratogenic effects and genetic alterations; for example, a localized cerebral palsy epidemic in Japan was associated with consumption of fish caught in a bay into which mercury was discharged by a manufacturer. We are able to recognize massive disasters and destroyed ecosystems after the fact, but lack the capability to diagnose incipient problems and predict effects of environmental modification. (Ketelle-Wisconsin)
W70-01584

## 5D. Waste Treatment Processes

**EVAPORATION SYSTEM RECOVERS CHEMICALS FROM PLATING WASTES,**
Pfaudler Permutit, Inc., Rochester, N.Y.
J. M. Culotta.
Water and Wastes Engineering, p 62-64, Mar 1967. 4 fig, 1 tab.

Descriptors: *Industrial wastes, *Evaporators, *Heat exchangers, Heat transfer, *Thermal pollution.
Identifiers: *Metal finishing wastes, *Waste heat, Rinse water, Closed loop, Dragout.

Significant advances have been made in handling cyanide and chromic acid plating waste operations by new sophisticated systems that recover the bulk of the wastes by evaporation, and neutralize or chemically destroy only the small fraction which is not economically recoverable. Described are: the closed-loop system, in which a single-effect evaporator concentrates flow from the rinse water holding tank, and the open-loop system. The circulation loop through the evaporator is opened by creating another loop for the cyanides. The dragout solution can be retreated before sewering. An economic table-analysis of this system is given. In the third system, called optimized system, 80-90% of the chromic acid normally lost by dragout is recovered from waste, through evaporation, by utilizing waste heat. This helps prevent thermal pollution also. (Rietveld-Vanderbilt)
W70-01384

**THE PRESENT POSITION OF THE EFFLUENT PROBLEM IN SWITZERLAND (IN GERMAN),**
F. Adam.
Textil-Rdsch, Vol 9, No 11, p 563-569, 1954.

Descriptors: *Domestic wastes, *Industrial wastes, *Waste water treatment, Treatment facilities, Waste treatment.
Identifiers: Chemical composition, Bleaching wastes, Dyeing wastes, Rayon, Man-made fiber production wastes, Wool washing wastes.

The author deals with the treatment of domestic sewage in biological plants and the effect of industrial waste waters on such plants, and discusses the composition once necessary preliminary treatment of waste waters from bleaching, wool washing, dyeing and rayon manufacture. (Livengood-North Carolina State Univ)
W70-01398

**DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,**
North Star Research and Development Inst., Minneapolis, Minn.
For primary bibliographic entry see Field 03A.
W70-01401

**THERMOPHYSICAL PROPERTIES OF SALINE WATER,**
Monsanto Research Corp., Everett, Mass. Boston Labs.
For primary bibliographic entry see Field 03A.
W70-01402

**SELECTIVE ELEMENT RECOVERY FROM OIL FIELD BRINES,**
Kansas Univ., Lawrence. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02K.
W70-01413

**WATER-QUALITY IMPROVEMENT BY GROUND-WATER RECHARGE,**
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 23-27, 1969. 5 p, 9 ref.

Descriptors: *Artificial recharge, *Waste water treatment, Biodegradation, Soil disposal fields, Denitrification, Water quality, Water chemistry, Water pollution control, Sanitary engineering, Sewage disposal, Water reuse, Groundwater movement.
Identifiers: Water quality improvement.

Aerobic percolation of low-quality water through soil to the water table and subsequent lateral movement below the water table can be effective mechanisms for removing biodegradable material, pathogenic organisms, and certain inorganic substances such as metals from the water. Recharge basins should be managed to avoid accumulation of suspended material on the bottom and to allow sufficient oxygen to enter the soil during dryups to satisfy the total oxygen demand of the water that has entered during inundation. Also, the basins should be so laid out and operated to avoid excessive water-table buildups while at the same time achieving maximum recharge per unit basin area. Nitrogen in the low-quality water will appear mostly as nitrates in the renovated water. For renovated sewage effluent, the nitrate content may be two to four times higher than the permissible limit for drinking water. Nitrate reduction by denitrification or other processes is emerging as a major problem in renovating sewage effluent, and research in this area is being intensified. (Knapp-USGS)
W70-01414

**SLUDGE DISPOSAL-AEROBIC AND ANAEROBIC DIGESTION - BASIC CONCEPTS,**
L. A. Allen.
Effluent and Water Treatment Manual, Vol 2, No 7, p 388-392, 1962.

Descriptors: *Aerobic treatment, *Anaerobic digestion, *Biodegradation, *Activated sludge, *Treatment facilities, Sludge treatment, SLUDGE DISPOSAL, Biological treatment, Organic matter.

The basic principles of aerobic and anaerobic digestion are discussed and their application to sludge disposal is critically examined. (Goodwin-North Carolina State Univ)
W70-01444

**PLANT INSTALLATIONS FOR INDUSTRIAL EFFLUENT TREATMENT,**
Ian M. E. Aitken, and Leslie E. Streatfield.
Effluent and Water Treatment Manual, Vol 5, no 5, p 253-256, and p 320-324, 1965. 9 p.

Descriptors: *Sedimentation, *Flotation, *Biological treatment, *Filtration, *Chemical reactions, Treatment facilities, Industrial wastes, Ion-exchange, Sludge treatment, Instrumentation.

A comprehensive report on the importance and necessity today of industries' having an effluent treatment plant that carries out its functions. The article covers treatment methods: 1-Sedimentation, 2-Filtration, 3-Flotation, 4-Chemical reaction (including ion-exchange), 5-Biological action; the sludge problem, abstraction of solids, recirculation, floation methods, instrumentation and automation, and planning plant installations. (Livengood-North Carolina State Univ)
W70-01479

**COLLOQUIUM ON WOOL SCOURING. Part 4. WOOL GREASE RECOVERY AND EFFLUENT TREATMENT,**
C. A. Anderson.
Textile J Australia Vol, 40, No 4, p 11-14, 1965.

Descriptors: Calcium Chloride, Centrifugation, Emulsions.
Identifiers: *Scouring waste, *Recovery (Waste), *Wool, Wool grease, Aqueous scouring, Solvent scouring, Suint, Acid degredation.

Methods of grease recovery from aqueous wool scour liquors and solvent extraction liquors are compared. (Goodwin-North Carolina State Univ)
W70-01483

**CRAZED RESIN FILTRATION OF COMBINED SEWER OVERFLOWS.**
Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
For primary bibliographic entry see Field 05G.
W70-01487

**SULFIDE TREATMENT OF ACID MINE DRAINAGE.**
Bituminous Coal Research, Inc., Monroeville, Pa.

Water Pollution Control Research Series, DAST-2, Nov 1969. 65 p, 6 tab, 9 fig, 41 ref. Available from the Clearinghouse as PB 187 866, $3.00 in paper copy, $0.65 in microfiche. FWPCA Grant No 14010 DLC.

Descriptors: Pollution abatement, Limestones, Hydrogen sulfide, *Sulfides, *Waste water treatment, Stream pollution, *Mine drainage, Coal mine wastes.
Identifiers: *Coal mine drainage, Iron sulfides.

The studies reported herein were a continuation of a 12-month program initiated in June 1967 with funds from the Appalachian Regional Commission. During this earlier program a process for the treatment of coal mine drainage was conceived, involving the combined addition of limestone and hydrogen sulfide to effect precipitation of iron sulfides (LHS process). Results of laboratory-scale continuous flow tests of the LHS process during the current program indicated that hydrogen sulfide feed must be accurately predetermined and controlled to effectively precipitate iron, yet to avoid an excess of reagent in the process effluent. The black sludge formed during treatment undergoes oxidation at a rate depending on drying conditions, with formation of elemental sulfur. X-ray diffraction analyses indicate the iron sulfide sludge component is an amorphous material, although chemical analyses indicate it is initially a stoichiometric compound whose empirical formula corresponds to that of ferrous sulfide. The unstable nature of the sulfide sludge, possibility of polysulfide formation during treatment, instability of mine waters of the type amenable to treatment, and inadequacies of available gas metering equipment are among the factors which militate against the controlled regulation of hydrogen sulfide feed necessary for successful operation of the process. These factors, and additional disadvantages revealed by an updated cost evaluation, lead to the conclusion that the LHS process is less attractive than accepted methods of mine drainage treatment.
W70-01488

**AERATED LAGOON HANDLES 10-MILLION GPD.**

Textile World, Vol 116, No 2, p 86-87, 1966.

Descriptors: *BOD, Aeration, Lagoons, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Desizing wastes, *Bleaching wastes, *Dyeing wastes, Textile wastes.

The aerated lagoon of Springs Cotton Mills Grace Bleachery is briefly described. (Goodwin-North Carolina State Univ)
W70-01491

**AN INDUSTRIAL WASTE GUIDE TO THE WOOL PROCESSING INDUSTRY.**

American Dyestuff Report, Vol 44, p 655-661, 1955. 58 p.

Descriptors: *Domestic wastes, *BOD, *Biological treatment, Water pollution effects, Waste treatment, Toxicity, Alkalinity, Detergents, Coagulation, Chemical precipitation, Biodegredation.
Identifiers: *Wool, *Dyeing wastes, *Scouring waste, Textile wastes, Fiber wastes, Recovery (Waste), Acid dyes, Wool grease.

Summarizes the sources of pollution in the wool processing industry, the polluting effects of woolen-mill wastes, and information on the methods of dealing with the waste problems of the industry. (Goodwin and Livengood, North Carolina State Univ)
W70-01493

**EFFLUENT TREATMENT IN DYEWORKS.**

Intern Dyer, Vol 134, p 871-873, 1965.

Descriptors: Organic matter, Sedimentation.
Identifiers: *Dyeing wastes, *Bleaching wastes, Effluent treatment, Biochemical oxidation, Chemical treatment.

This is a brief review of the work reported by the Shirley Institute in leaflets and at the open-days of the Cotton Silk and Man-Made Fibers Research Assoc. on effluent treatment studies.
W70-01495

**HOW TO TREAT TEXTILE WASTES.**

Wastes Eng, Vol 32, No 1, p 188-189, 1961.

Descriptors: *Sludge disposal, *Chemical precipitation, *Filtration, *Aeration, *Neutralization, *Separation techniques, Waste treatment, Cotton, BOD, Trickling filters, Biological treatment.
Identifiers: *Equalization, Textile wastes.

Remarks from two reports: (1) A Simplification of Textile Waste Survey and Treatment, by N. England Interstate Water Pollution Control Commission; and (2) Cotton Textile Industry, by Public Health Service. Factors to be considered to determine if waste treatment is necessary and which treatment is best.
W70-01496

**LATEST WORD ON LOW-COST MILL-WASTE DISPOSAL.**

Textile World, Vol 110, No 6, p 71-75, 1960.

Descriptors: *BOD, Waste disposal, Aeration, Alkalinity, Hydrogen Ion Concentration, Lagoons.
Identifiers: *Textile wastes, *Dyeing wastes, *Chemical composition, Sulfur dyes, Recovery (Waste), Sodium hydroxide.

Emphasis is on discharge of mill and dyehouse wastes into streams; suggestions are made for handling waste by cutting waste volume, changing process, separating wastes, building aeration system, or using bisorption system.
W70-01497

**NEW ION-EXCHANGE RESINS FOR PURIFYING WATER.**

Wool Record, 107, No 2903, p 35-36, 1965.

Descriptors: *Water purification, *Ion-exchange.
Identifiers: Organic poisoning, Anion exchange resins, Polystyrene, Crosslinking, Isoporous structure.

New resins for use in anion-exchange systems for water purification are described briefly.
W70-01498

**PRETREATMENT PLANT FOR WOOL FACTORY EFFLUENT: WEAR AND TEES RIVER BOARD.**

Engineer, Vol 214, p 601, 1962.

Descriptors: *Treatment facilities, BOD, Calcium chloride, Waste water treatment, Filtration.
Identifiers: *Wool, *Textile wastes, Wool grease.

A new technique using calcium chloride as the reagent reduces the BOD load to about 1500 lb/day is described. In operation at Head Wrightson Processes Ltd., Imperial Chemical Industries Ltd., and Patons and Baldwins Ltd.
W70-01500

**PROBLEM OF SISAL EFFLUENT.**

Effluent and Water Treat J, Vol 3, p 643, 1963.

Descriptors: Treatment facilities, Separation techniques, Solid wastes, Organic matter, Filtration.
Identifiers: Sisal, Fiber wastes.

A new plant for separating liquid and solid sisal wastes is described.
W70-01501

**PROCESS FOR TREATING WATER.**

British Patent 955, 321 to Esso Research and Engineering Company. Apr 15, 1946.

Descriptors: *Waste water treatment, *Organic compounds, *Chemical wastes, Treatment facilities, Oxidation, Temperature, Activated carbon, Sewage, Biodegradation, Detergents, Electrodialysis, Absorption, Activated sludge, Foam fractionation, Aeration, Acidity, Carbon dioxide, Solid wastes, Foaming.
Identifiers: Alkylbenzene sulfonates, Dyeing wastes, Solar evaporation.

A process is claimed for removing water-soluble organic compounds from sewage-works effluents and trade waste waters which are free from suspended solids. High-molecular compounds, particularly low concentrations of non-biodegradable water-soluble compounds, such as synthetic detergents, are removed by foam fractionation, and low-molecular organic compounds are then removed by electrodialysis or absorption on activated carbon. A design is also claimed for a treatment plant incorporating an activated sludge unit, foam-fractionation column, and apparatus for collapse of foam by heating or agitation. Effluent from the activated sludge tank is passed to the foam-fractionation column, or, alternatively, if foam is present in the activated-sludge tank it may be skimmed off and passed direct to the foam-collapsing apparatus. Gas is taken from the aeration tank and supplemented with air for use in foaming. Fine bubbles are used and the bubble size and acidity must be controlled carefully. The rate of gassing must be adjusted to maintain a distinct foam-liquid interface and a stable foam must also be maintained (by using a foam column of narrow diameter and, if necessary, adding a small amount of alkylbenzene-sulphonate to increase the foam stability of weakly surface-active contaminants). The collapsed foam can be recirculated to the foam-fractionation column to further concentrate the organic impurities which are subsequently oxidized to carbon dioxide and water at high temperature and pressure. Alternatively, organic compounds, such as phenol, could be recovered from the collapsed foam by solar evaporation. When used to treat secondary sewage effluents, the process removed 87 percent.
W70-01504

**REVIEW OF PAPERS PRESENTED AT THE 1965 EFFLUENT AND WATER TREATMENT CONVENTION.**

Effluent and Water Treat J, Vol 5, No 3, p 134-136, 1965.

Descriptors: *Legislation, Waste water treatment, Pulp wastes, Treatment facilities, Water pollution control, Evaporation, Electrodialysis, Ion exchange, Sludge disposal, Instrumentation.
Identifiers: Effluent treatment, Textile wastes, Recovery (Waste).

Reviewed are eight articles by the following persons: M. A. Kershaw, A. S. Wisdom, C. Rhodes and others, Ian M. Aitken, T. G. Noble, S. E. Punt and W. J. M. Cook, P. S. A. Northcott, and J. F. Wilkes and H. Kerst. These papers covered water controls, installations, and treatment pertaining to paper mills, textile wastes and other water pollutants.
W70-01505

**STREAM POLLUTION REDUCTION PROGRAM FOR FINISHING PLANT.**

Textile Ind, Vol 121, No 7, p 71-73, 1957.

Descriptors: *Treatment facilities, *BOD, Waste treatment, Economics, Activated sludge, Toxicity, Flow rates, Fish.
Identifiers: *Bleaching wastes, *Finishing wastes, Starch, Dyeing wastes.

A waste treatment plant and program designed for Hohokus Bleachery is described.
W70-01507

**SYMPOSIUM ON WASTE-DISPOSAL PROBLEMS OF SOUTHERN MILLS.**

American Dyestuff Reptr, Vol 44, No 12, p 379-400, 1966.

Descriptors: *Legislation, *Standards, *Biological treatment, Pollution abatement, Waste treatment, Alkalinity, Sewage, Water pollution control.
Identifiers: *Bleaching wastes, *Dyeing wastes, *Slashing wastes, Recovery (Waste), Sodium hydroxide.

Papers on Relation of Federal stream pollution to laws and industry, Cotton slashing with synthetic compounds as means toward pollution abatement; Bleaching and dyehouse waste studies; Textile waste treatment in Texas; Biological treatment of mixture of highly alkaline textile-mill waste and sewage; Classification of streams in Georgia, South Carolina and North Carolina; Pollution control by recovery of caustic soda.
W70-01508

**TEXTILE WASTE DISPOSAL SYMPOSIUM.**

American Dyestuff Reptr, Vol 47, No 14, p P473-P491, 1958.

Descriptors: *Domestic wastes, *BOD, Water pollution control, Waste disposal, Cotton, Coagulation, Biological treatment, Hydrogen-Ion concentration, Trickling filters, Standards, Toxicity, Waste water treatment.
Identifiers: *Scouring waste, *Slashing wastes, *Desizing wastes, *Bleaching wastes, Finishing wastes, Mercerizing wastes, Starch, Wool, CMC, Sodium hydroxide.

Papers are presented on Disposal of combined textile finishing wastes and domestic sewage; Pollution control of New England Interstate Waters.
W70-01510

**THE BOD OF TEXTILE CHEMICALS: UPDATED LIST - 1966.**

American Dyestuff Reptr, Vol 55, p P685-688, 1966. 9 refs.

Descriptors: *Biochemical oxygen demand, Bio degradation, Test procedures.
Identifiers: *Textile chemicals, Chemical composition.

RA58 Stream Sanitation Technol. AATCC Committee. The list gives (1) name of chemical, (2) 5-day BOD, %, (3) references, (4) chemical composition and use.
W70-01511

**THE SECOND INTERNATIONAL MAN-MADE FIBRE SYMPOSIUM - 1965 IN BERLIN (IN GERMAN).**

Faserforsch, u. Textiltech, Vol 16, No 7, p 363-371, 1965.

Descriptors: Conferences.
Identifiers: Effluent treatment, Man-made fiber production wastes.

Short reports of the following papers are published together: 'The polymerization of w-aminocarboxylic acid lactams' by P. Schlack; 'Reaction mechanisms in polyethylene terephthalate melts' by B. Zimmermann and others; 'Fibre formation from polypropylene and modified polypropylene' by F. Geleji and others; 'A study of stretching processes in polypropylene' by M. Jambrich, I. Diacik, and P. Hravnak; 'The influence of processing and finishing on glass fibre properties' by W. Bobeth, R. Barthel, and G. Wiedemann; 'Two structural classes among man-made fibres' by N. V. Michajlov; 'The paracrystalline fibrillar structure in polyethylene which has been drawn and tempered by various methods' by R. Hosemann, R. J. Balta Celleja, and W. Wilke; 'An investigation of the supermolecular structure of man-made fibres' by A. B. Paksver and L. S. Gerasimova; 'The state of solution of high polymers' by C. Ruscher; 'New studies on the solution state in cellulose solutions' by J. Schurz; 'Physico - chemical studies of the supermolecular structure of high strength regenerated cellulose fibres' by B. Philipp and J. Baudisch; 'Investigations of structural changes in cellulose during the viscose process, with the aid of deuterium exchange and infrared techniques' by G. Wlodarski; 'Possible methods of structure formation in regenerated cellulose fibres' by V. Beseda, M. Kozler, and F. Lauko; 'Kinetic studies on the break-down of xanthic acids' by Z. Cichowski; 'The normal solution properties of viscose with respect to ultra filtration and flocculation behavior by A. Matthew, A. Grundling, and M. Rosezberg. (Goodwin and Livengood-North Carolina State Univ)
W70-01512

**WASTE WATERS FROM THE WASHING OF WOOL.**

Bull Mens Centre Belge et Document. Eaux, No 71, p 432-434, 1956.

Descriptors: *Waste water treatment.
Identifiers: *Scouring waste, *Wool, Lanolin.

In connection with the recent Commission dealing with the purification of the River Vesdre, Belgium, and the problems of lanolin in this river; a brief summary is given of work on similar problems in New England and details are given of the method of treating wool scouring waste waters. (Goodwin and Livengood-North Carolina State Univ)
W70-01513

**WATER AND EFFLUENTS.**

Intern Dyer, Vol 136, p 916-918, 1966.

Descriptors: *Biochemical Oxygen Demand, Water, Alkalinity, Acidity, Biochemical treatment, Activated sludge, Anaerobic digestion, Standards, Ion exchange, Economics, Hardness (Water).
Identifiers: *Catonic surfactants, *Noidnic surfactants, *Anionic surfactants, *Dyeing wastes, Percolating filters, Dye house, Effluent treatment.

Summaries are given of the following papers presented at a half-day symposium by the London Region of the Soc. of Dyers and Colourists on November 4, 1966: (1) Water for the dyehouse, by T. H. Morton; (2) Water usage in rinsing, by G. J. Parish; (3) Surface-active agents in processes and effluents, by W. V. Barnes and S. Dobson; and (4) Treatment of effluents, by A. H. Little. (Goodwin and Livengood-North Carolina State Univ)
W70-01514

**PLASTICS IN WASTE TREATMENT,**
M. W. Askew.
Process Biochem, Vol 1, p 483-486, 492, 1966; Vol 2, p 31-34, 1967.

Descriptors: *Standards, *Waste treatment, *Plastics, *Filtration, Activated sludge, Waste water treatment, Foods.
Identifiers: Polyvinyls.

The author discusses the standards for trade effluent imposed and expected in Europe, Canada and U.S.A. As a result of these higher standards new methods of treatment have been devised using polyvinyl chloride corrugated-sheeting units which can be used in place of established biological filtration media, where cost, space and technical problems make the use of activated-sluge tanks and other conventional methods impracticable. The characteristics of Flocor medium and its advantages over conventional filter media are described and examples are given of its use to treat waste waters from distilleries, breweries, fruit and vegetable processing, and textile plants. (Livengood-North Carolina State Univ)
W70-01515

**STUDY OF DYEWORKS WASTE WATERS (IN FRENCH),**
R. Baetsle.
Bull Mens Centre Belge et Document, Eau, No 27, p 16-29, 1955.

Descriptors: *Water analysis, Cotton, Water supply, Waste water (Pollution), Water pollution effects, Waste water treatment.
Identifiers: *Dyeing wastes, *Chemical composition.

Taking two examples of dye works associated with the cotton industry results are shown in tables of physical and chemical analyses of water supply and waste waters in each case. The effects of discharge of waste waters on the receiving rivers are also illustrated by means of tables and possible methods of treatments are discussed. (Livengood-North Carolina State Univ)
W70-01517

**MECHANISM OF STARCH REMOVAL IN THE ACTIVATED SLUDGE PROCESS,**
Delaware Univ., Newark; and Illinois Univ., Urbana.
S. K. Bannerji, B. B. Ewing, R. S. Englebrecht, and R. E. Speece.
J Water Pollution Control Fed, Vol 40, No 1, p 16-29, Jan 1968.

Descriptors: *Activated sludge, *Biodegradation, Colloids, Waste water treatment, Biological treatment, COD, Enzymes.
Identifiers: *Starch, Desizing wastes.

A laboratory experiment on the removal of colloidal wastes from wastewater (e.g., starch from textile desizing processes) is reported. An explanation of the mechanisms involved in removal of potato starch by activated sludge is offered. (Goodwin and Livengood-North Carolina State Univ)
W70-01518

**ADSORPTIVE REMOVAL OF AROMATIC COMPOUNDS FROM THE WASTE WATERS OF ANILINE DYE WORKS (IN RUSSIAN),**
R. M. Bekher.
Ukrain Khim Zhur, Vol 27, p 268-273, 1961.

Descriptors: *Activated carbon, *Waste water treatment, Adsorption, Phenols, Separation techniques.
Identifiers: *Dyeing wastes, *Aniline black dyes, Benzene, Toluene.

An absorption method for treating aniline dye manufacture waste waters with activated C (KAD) is described in which the mononitro-derivative of benzene, chlorobenzene, toluene, phenol, and cresol, dinitrochlorobenzene, p-nitrophenol and 2, 4, 5 trichlorophenol are removed. Methods for regenerating the charcoal and separating the contaminants are discussed briefly and the adsorption capacity and required period of contact for each material are quoted, with details of results achieved. (Livengood-North Carolina State Univ)
W70-01520

**DISPOSAL OF SEWAGE EFFLUENT AT MADISON, WIS,**
Madison Metropolitan Sewerage District, Wis.
H. O. Lord.
Sewage and Industrial Wastes, Vol 22, No 1, Jan 1950. 1 fig.

Descriptors: *Sewage effluent, *Legal aspects, *Legislation, Sanitray districts, Chemical precipitation, Trickling filters, Activated sludge, Nitrogen, Phosphorus, Wisconsin, Water pollution sources, Water pollution effects, Waste treatment, Nutrients, Eutrophication.
Identifiers: *Effluent disposal, *Madison (Wis), *Treatment requirements, Nuisance conditions, Algal growth, Nutrient sources, Lake investigations, Court orders, Effluent quality, Lake Mendota (Wis), Lake Monona (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis), Yahara River (Wis).

An historical account is presented of disposal of sewage effluents at Madison, Wisconsin, from 1884 (when sanitary districts served by public sewers were first developed) to 1950. In 1898, the first sewage treatment began, utilizing chemical precipitation. In 1901, a trickling filter plant replaced the original unit. Activated sludge treatment was inaugurated in 1914. Population growth by 1928 necessitated addition of a second plant and several subsequent modifications. Nuisance conditions have long been attributed to the lakes' overenrichment with sewage effluents. A committee, appointed by the Governor in 1941, to study the Madison lakes, proposed that removal of nitrogen and phosphorus from effluents would significantly contribute to abatement of the nuisance conditions. The legislature enacted a law in 1943, prohibiting discharge of sewage effluents into lakes (apparently tailored specifically for the Madison area). An order by the State Board of Health, requiring Madison's sewage effluent to be discharged outside the drainage basin, was found unlawful and reversed after judicial review in 1948. The original 1943 law was amended in 1949 to permit exemption from the requirement if adequate treatment was provided. (Ketelle-Wisconsin)
W70-01580

## 5E. Ultimate Disposal of Wastes

**SOIL SEALING CHEMICALS AND TECHNIQUES,**
Diamond Shamrock Corp., Painesville, Ohio. T. R. Evans Research Center.
J. J. Mannion, and D. J. Porter.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.40 per copy. Office Saline Water Res and Develop Progr Rep No 381, 1968. 31 p, 4 fig, 11 tab. Contract No 14-01-0001-1289 OSW.

Descriptors: *Soil sealants, *Analytical techniques, *Waste water disposal, Brines, Lignins, Soil moisture, Permeability, Permeameters, Cost analysis, Cellulose, Additives, Research and development.
Identifiers: *Lignin derivatives, Sodium chromate, Alum, Carboxymethyl cellulose, Petroleum emulsions.

Materials to be used in making soils impermeable to concentrated brine for disposal by evaporation were studied. Roswell soil from New Mexico was rendered impervious by four classes of additives, namely, lignin derivatives gelled with sodium chromate or alum, carboxymethyl cellulose with alum, petroleum emulsions, and an attapulgite clay. Soil permeability was sensitive to moisture content. This relationship should be considered in research experiments with additives and in field installation procedures. The reproducibility of results in small permeameters was not as good as expected because of insufficient control of moisture levels. Permeability tests of longer duration need to be made before any major installation is contemplated. A graphical technique for comparing treatment costs and effectiveness is suggested. The additive cost for

reducing the seepage at Roswell to less than 6 inches per year at a brine depth of 20 feet by treating a 6-inch soil layer can be as low as $500 per acre. A graphical technique for comparing treatment costs and effectiveness is suggested. (Carstea-USGS)
W70-01273

**BEACHES.**
For primary bibliographic entry see Field 06E.
W70-01310

**A STUDY OF DEEP WELL DISPOSAL OF DESALINATION BRINE WASTE,**
Dow Chemical Co., Freeport, Tex.
P. G. LeGros, C. E. Gustafson, G. L. Nevill, E. C. Majeske, and R. D. Mathews.
Offc of Saline Water Research and Development Progress Report No 456. June 1969. 259 p. OSW Contract 14-01-0001-1691.

Descriptors: *Brine disposal, *Brines, *Saline water, *Deep wells, *Injection wells, Waste disposal, Subsurface investigations, Desalination.
Identifiers: *Deep well disposal, Deep well usage, Geologic considerations, Desalting.

Seven inland U.S. communities were selected as examples for the design of deep well disposal facilities for the desalination waste brines. The water needs, the geological structures, and other pertinent data were accumulated for each of the seven communities. Actual values were used wherever available. Injection wells and surface equipment were designed for each community, and estimates were made of the cost of construction and operation of the designed disposal system in each. The developed costs vary from a low of 2.5 cents per 1000 gallons of product water at Arkansas City to a high of 35.1 cents at Fort Morgan. This spread in costs represents the expected ranges due to variations in geology, geography and plant size. (Gransee-Office of Saline Water)
W70-01480

## 5F. Water Treatment and Quality Alteration

**DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,**
North Star Research and Development Inst., Minneapolis, Minn.
For primary bibliographic entry see Field 03A.
W70-01401

**DISPOSAL OF INDUSTRIAL WASTE MATERIALS.**

Society of Chem Ind, London, 1957. 157 p.

Descriptors: *Detergents, Industrial wastes, Waste disposal, Surfactants, Cotton.
Identifiers: *Fiber wastes, *Man-made fiber production wastes, *Bleaching wastes, Dyeing wastes, *Finishing wastes, *Printing wastes, Wool, Silk, Rayon, Acetate.

These are papers read at the conference at Sheffield University, April 17-19, 1956, with the discussions that followed.
W70-01494

**1966 BOOK OF ASTM STANDARDS. INDUSTRIAL WATER: ATMOSPHERIC ANALYSIS.**

Am Soc for Testing and Materials, p 878, 1966.

Descriptors: *Ion exchange, Standards, Industrial wastes, Water analysis.
Identifiers: Chemical composition.

ASTM standards relating to industrial water, industrial waste water, and atmospheric analysis are included.
W70-01499

**PROCEEDINGS OF THE THIRTEENTH SOUTHERN MUNICIPAL AND INDUSTRIAL WASTE CONFERENCE.**

Duke University, Durham, NC, p 212, April 16 and 17, 1964.

Descriptors: *Standards, *Legislation, *Biological treatment, *Aeration, *Dissolved oxygen, Water resources, Water pollution control, Hydrogen ion concentration, Oxygen sag, Surface waters, Kinetics, BOD, Activated sludge, Color, Canners, Cotton.
Identifiers: Textile wastes, Wool, Water tracing techniques.

Of textile interest are a symposium (an appraisal of regulatory statutes relating to control of pollution) and the following paper: 'Interrelationships Among Water Resources, Pollution Control, and Growth of the Textile Industry in the Southeast' (35 refs.), by T. A. Alspaugh, p. 167-203.
W70-01502

**PROCEEDINGS OF THE 21ST INDUSTRIAL WASTE CONFERENCE.**

Purdue University and Ind State Board of Health. May 3-5, 1966. Purdue University, Lafayette, Ind, p 1017.

Descriptors: *Activated sludge, *Foam - separation, Industrial wastes, Conferences, Biological treatment, Waste water treatment, Synthetic polymers, Biodegredation, Coagulation, Flocculation, COD.
Identifiers: *Starch, *Recovery (Waste), *Sodium hydroxide, *Man-made fiber production wastes, Proteins, Textile wastes, Keratin, Molecular structure, Mercerizing wastes.

The following papers of particular interest to the textile industry are included: (1) 'Biological Treatment of Waste Water from Synthetic Resin Manufacture' by K. G. Singleton (Ciba (A.R.L.) Ltd.,). P><=+. (2) 'Mechanism of Starch Removal in Activated Sludge Process' by S. K. Banerji, B. B. Ewing, R. S. Engelbrecht, and R. E. Speece, p. 84-102. (3) 'Sodium Hydroxide Recovery in the Textile Industry' by C. S. Carrique and L. U. Jaurequi (Univ. of Buenos Aires), p. 861-868. (4) 'Utilization of Resistant Proteins (e.g. Keratin) by Activated Sludge' by G. J. Capestany (Municipality of Metropolitan Seattle) and D. A. Carlson (Univ. of Washington), p. 943-952.
W70-01503

**TEXTILE EFFLUENT TREATMENT AND DISPOSAL.**

Cotton Silk and Man-made Fibres Research Association, Manchester (Shirley Institute Pamphlet No 92) p 92, 1966.

Descriptors: *Waste disposal, *Waste water treatment, *Legislation, *Standards, Surface waters, Self-purification, Flow rate, BOD, COD, Cotton, Sedimentation, Chemical precipitation, Biological treatment, Anaerobic digestion, Aerobic treatment.
Identifiers: *Fiber-production wastes, Effluent treatment, Textile wastes, Chemical composition, Wool.

Papers read at a conference on 17th November, 1965, are presented: 'Planning for Trade-Effluent Disposal' by P. C. G. Isaac (pp. 9-34), 'Treatment of Waste Waters from the Textile Industry' by A. B. Wheatland (pp. 35-59), 'Pollution by Textile Effluents in the Mersey Basin' by C. Lumb (pp. 60-76), and 'Stratification in Sedimentation Tanks' by A. H. Little (pp. 77-92).
W70-01509

**ZINC RECOVERY FROM VISCOSE RAYON EFFLUENT,**
R. S. Aston.
Ont Ind Waste Conf, Proc No 13, p 215-230, 1966.

Descriptors: Ion exchange, Evaporation.
Identifiers: *Recovery (Waste), *Zinc sulfate, *Rayon, *Man-made fiber production wastes, Zinc compounds, Sulfuric acid, Cationic exchange resins.

The recovery of Zn, in the form of ZnSO4, by ion exchange was successfully applied to the treatment of effluent liquors from a viscose rayon plant. The resin used was Permutit Q, a cation exchanger of the sulfonated polystyrene type, operating in the H cycle and regenerated with H2SO4. The process is more effective than an evapn. process in reducing the Zn pollution content, since large vols. contg. a low concn, may be treated. The tech. and economic feasibility is enhanced at plants that produce different types of viscose yarn. At the Cornwall plant of Courtauls (Canada) Ltd., the Zn discharge to the river was reduced by 80%. (Livengood-North Carolina State Univ)
W70-01516

**PRACTICAL ASPECTS OF THE DESIGN OF WASTE STABILIZATION PONDS,**
W. D. Barlow.
Proc 9th Sth Munic Industr Waste Conf, p 65-70, 1960.

Descriptors: *Lagoons, *Domestic wastes, Waste water treatment, Industrial wastes, Neutrients, Bacteria, Algae, Treatment facilities, Test procedures, Metals.
Identifiers: *Finishing wastes.

Lagoons can be designed to provide complete treatment for any waste water, domestic and/or industrial, provided it contains the necessary nutrients and is free from substances which are toxic to bacteria or algae. The author discusses the basic processes involved; factors affecting the design and operation of the lagoon (particularly under conditions in North and South Carolina); performance of the lagoon, including methods of measurement; and precautions to be taken to avoid health hazards, pollution and other nuisance problems. In discussion, reference was made to lagoons used for treating mixed waste waters and 20-30 per cent of domestic sewage, and especially to the problems encountered which appear to be caused by toxic metals in the waste water. (Livengood-North Carolina State Univ)
W70-01519

## 5G. Water Quality Control

**WATER SUPPLY IN COLD REGIONS,**
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W70-01259

**WATER POLLUTION CONTROL.**

Ky Rev Stat Ann secs 224.010-224.130 (Supp 1968).

Descriptors: *Pollution, *Kentucky, *Water pollution control, *Standards, Waste treatment, Administrative agencies, Local governments, State governments, Damages, Permits, Control, Legal aspects, Legislation, Waste disposal, Fish, Fish stocking, Interstate compacts, Water pollution, Water pollution sources, Permits, Abatement, Water management, Water law, Water quality control, United States.

Kentucky has provided a program for the establishment and enforcement of standards concerning water pollution. A Water Pollution Control Commission is established to preserve the waters of the state for the use of the public, to protect fish and

wildlife, and to prohibit water pollution. The Commission shall issue permits providing for construction or modification of disposal systems. By regulating these permits, the Commission is able to control who has rights of disposal and how much they may dispose. The state is empowered to sue to recover costs for restocking and restoring fish and wildlife which are destroyed as a result of illegal disposal activities. The Ohio River Valley Water Sanitation Compact is accepted and enacted into law. This Compact provides for an interstate effort to establish standards and regulate pollution of the Ohio River Valley. (Darragh-Florida)
W70-01307

**WATER POLLUTION CONTROL.**
Ky Rev Stat Ann secs 224.010-224.040 (Supp 1968).

Descriptors: *Kentucky, *Water pollution, *Administrative agencies, *Water resources development, Federal government, Waste disposal, Waste water disposal, Planning, Legislation, Coordination, Water quality, Water pollution control, Standards, Regulation, Permits, Investigations, Benefits, Water treatment.

It is the policy and purpose of the state of Kentucky to conserve its water resources, to provide for the prevention of pollution, and to cooperate with all federal programs to these ends. To further these purposes, a Water Pollution Control Commission is established within the Department of Health. The Commission may exercise authority, power, and duties concerning: (1) furtherance of the aims of this act; (2) development of a comprehensive plan for control of pollution; (3) cooperation with all relevant federal agencies; (4) conducting studies relating to water pollution; (5) establishment of water quality standards; (6) establishment of rules and regulation for pollution control; (7) issuance of orders of abatement; (8) examination of all plans for construction of disposal systems; (9) regulation of permits for waste disposal; (10) conducting investigations; (11) institution of proceedings to force compliance; and (12) taking necessary action to secure the benefits available under the Federal Water Pollution Control Act. (Darragh-Florida)
W70-01308

**WATER POLLUTION CONTROL.**
Ky Rev Stat Ann secs 224.060-224.130 (Supp 1968).

Descriptors: *Waste treatment, *Pollution, *Kentucky, *Water pollution control, Administrative agencies, Local governments, Damages, Permits, Legislation, Interstate compacts, Waste disposal, Fish, Fish stocking, Standards, Regulation, Legal aspects, Water pollution, Water treatment, Water quality, Pollution abatement, Pollutant identification, Fish kill.

It shall be unlawful for any person to discharge any waste into the waters of the Commonwealth in contravention of the standards established by the Water Pollution Control Commission. No new source of discharge or any proposed change in any old source of discharge may be made without first obtaining a permit from this Commission. No establishment may be changed so as to cause a substantial increase in the discharge of waste without first obtaining a permit. If between meetings of the Commission the executive director finds that an emergency exists, he may ask the Governor to issue an appropriate order. Public hearings shall be held concerning the issuance of permits. Orders to control pollution will be issued at such hearings. Where injury, death, or destruction results to fish from pollution activities, the persons responsible for such pollution shall be liable for the cost of restocking or replenishing such fish. The Ohio River Valley Water Sanitation Compact, which was adopted to reduce and control pollution of the Ohio River, is approved and enacted into law. (Darragh-Florida)
W70-01309

**SAMPLING FOR WATER POLLUTION.**
Va Code Ann 29-35.1, 29-35.2 (1969).

Descriptors: *Virginia, *Water pollution, *Pollution abatement, *Water pollution control, Water pollution treatment, Pollutant identification, Analytical techniques, Chemical analysis, Cities, Streams, Sampling, Administrative agencies, Water law, Legal aspects, Legislation.

Any game warden may be requested by a member of the governing body of a county, city, or town to take samples from any stream believed to be polluted. The warden sends the sealed sample and a report of pertinent circumstances to the State Water Control Board. If on chemical analysis the water is found to be polluted, the Board has further studies and analyses performed to determine the nature and extent of such pollution and the most effective measures for controlling the same. (McDonough-Florida)
W70-01312

**WATERS OF THE STATE: REGULATION OF INDUSTRIAL ESTABLISHMENTS.**
Va Code Ann secs 62.1-28 thru 62.1-30 (1968).

Descriptors: *Virginia, *Water pollution, *Industrial wastes, *Water pollution control, Abatement, Pollution effects, Non-structural alternatives, Pollutants, Water pollution treatment, Water quality control, Water pollution sources, Wastes, Pollution abatement, Disposal, Legal aspects, Legislation, State governments.

Any owner of an industrial establishment which, in its operation, would cause pollution of the state's waters must provide facilities for treatment of industrial wastes or take such measures as will prevent pollution before operation of the establishment may commence. Any owner proposing to discharge industrial wastes or otherwise alter the physical, chemical, or biological properties of state waters must secure a permit from the State Water Control Board. Any owner who handles, stores, distributes, or produces other wastes shall, upon request of the Board, install facilities or adopt procedures approved by the Board as are necessary to prevent the discharge or escape of pollutants into state waters. (Kelly-Florida)
W70-01319

**PROHIBITION OF WATER POLLUTION.**
R I Gen Laws Ann secs 46-12-4 thru 46-12-7 (Supp 1968).

Descriptors: *Rhode Island, *Water pollution control, *Administrative agencies, Water pollution treatment, Wastes, Sewage, Sewage treatment, Pollution abatement, Water quality control, Investigations, Industrial wastes, Water pollution sources, Water pollution effects, Legislation, Legal aspects, Administration, Supervisory control (Power).

No person may cause or place sewage in a location likely to cause pollution of the state's waters. The statute prohibits construction or modification of sewage disposal systems, activities increasing the volume or strength of present sewage discharge, and construction of any industrial or commercial establishment whose operation may result in discharge of sewage, unless these actions have the approval of the Director of the Department of Health. If the Director believes that a violation of the chapter is taking place, he must initiate an investigation. Evidentiary hearings are required before violation may be found to exist. The Director may employ such professional or expert services as he requires to aid in investigation or prosecution of a suspected violation. (Kelly-Florida)
W70-01328

**ADOPTION OF APPROVED POLLUTION PREVENTION SYSTEMS.**
RI Gen Laws Ann secs 46-12-8 thru 46-12-15 (Supp 1968).

Descriptors: *Rhode Island, *Water pollution control, *Adoption of practices, *Pollution abatement, Sewage treatment, Water pollution treatment, Project planning, Planning, Water quality control, Water pollution effects, Water pollution sources, Administrative agencies, Administration, Public health, Legal aspects, Legislation, Supervisory control (Power).
Identifiers: Penalties (Criminal).

The Director of the Department of Health may order any person who is polluting the waters of the state to adopt a practicable and reasonably available system or means to prevent such pollution. If more than one system is available, an option may be given. The time limit for adoption of such system is fixed by the Director, but is subject to modification upon application by the person subject to the order. The operation of a pollution control system approved by the Director is sufficient to constitute compliance with all orders issued by the Director during his term in office. Violation of an order of the Director is punishable by fine and/or imprisonment; each day of violation is considered a separate offense. The Director has the power to inspect and to make orders regulating the means and devices utilized by all vessels and land installations for handling petroleum, gasoline, kerosene, tar, oil, or any mixture thereof for the purpose of preventing the discharge or escape of such substances into the waters of the state. (Kelly-Florida)
W70-01329

**DISCHARGE OF SEWAGE.**

RI Gen Laws Ann secs 46-12-24, 46-12-25, 46-12-33 (Supp 1968).

Descriptors: *Rhode Island, *Sewage treatment, *Water pollution control, *Pollution abatement, Disposal, Wastes, Local governments, State jurisdiction, Construction, Construction costs, Cost allocation, Grants, Federal government, Administrative agencies, Administration, Water pollution treatment, Water pollution sources, Legislation, Legal aspects.

The Director of the Department of Health may consult with and advise any person who discharges or empties sewage into the waters of the state as to the best method to prevent such sewage from polluting those waters. At the Director's request, any person now having a sewer or drain discharging into state waters or upon the beaches thereof must submit a statement describing all such sewers and drains owned or controlled by him together with a description of any works or methods employed to purify or otherwise alter the character of the sewage. Such statements shall be confidential unless made by a municipal corporation. The Director is authorized to grant state funds to municipalities, districts, and agencies for the construction of necessary facilities to prevent the discharge of untreated or inadequately treated sewage into state waters. The grants can be made only for projects which qualify under the Federal Water Pollution Control Act, and only when the director has been informed of project specifications. (Kelly-Florida)
W70-01330

**WATER POLLUTION CONTROL.**
RI Gen Laws Ann secs 46-12-30, 46-12-32 (1956).

Descriptors: *Rhode Island, *Water pollution control, *Impaired water quality, *Cities, Financing, Administrative agencies, Regulation, Control, Legislation, Local governments, State governments, Ice, Legal aspects, Water quality control, Water pollution, Public health, Standards, Water quality, Planning.
Identifiers: Drinking water, Ice supply.

No person shall be held to have violated the provisions of this chapter where the sole damage caused by him is the rendering unsuitable for drinking purposes or ice supply the waters polluted by him. Town and city councils may expend money to pay

for pollution control in their town or city, and may raise such money by the issue of interest-bearing notes. However, before the issuance of such notes, all plans and specifications for water pollution control must be submitted to and receive the approval of the State Department of Health. (Marsee-Florida)
W70-01331

**THE ABATEMENT OF POLLUTION.**
Council of Economic Advisors, Washington, D.C.

Controlling Pollution the Economics of a Cleaner America, edited by M I Goldman, Englewood Cliffs, Prentice-Hall, p 171-175, 1967. 5 p.

Descriptors: *Waste treatment, *Pollution abatement, *Federal Government, *Water pollution, *Water quality, Effluents, Waste discharge, Population, Air pollution, Sewerage, Rivers, Fishing, Agriculture, Economics, Economic incentives.
Identifiers: *Water Pollution Control Act, Garbage, Junk automobiles.

This article indicates the federal government's view of the problem of pollution abatement and its current and future role in such abatement. Government already provides for waste disposal and collection and disposal of water-borne wastes. An incentive system to abate waste discharges is proposed as a further measure in the form of taxes or charges levied on a pollutor. Water quality standards must be federally enforced if such pollution endangers the health or welfare of the public. Control agencies should then propose, and legally insist on, remedial measures for such situations. The recent establishment of the Water Pollution Control Administration is expected to facilitate these goals and the act which established the Administration also provides for technical assistance for waste treatment facilities, although financial aid has been limited. The federal government's role should be shouldered by localities, states, corporations and individuals if pollution abatement is to be successful. (Murphy-Rutgers)
W70-01349

**MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS,**
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese, and Blair T. Bower.
Baltimore, Maryland, The Johns Hopkins Press, 328p, 1968.

Descriptors: *Costs, *Government, *Resource allocation, Water quality, Sewage, Aesthetics, Industrial wastes, Filtration, Aeration, Effluents, Reservoirs, Computers, Capital costs, Damages, Biochemical oxygen demand, Degradation, Marginal costs, Dissolved oxygen, Groundwater aquifers, Legal aspects, Organic wastes, Chloride, Delaware, Domestic wastes, Irrigation thermal properties, Recreation.
Identifiers: *Potomac, Damage functions, Degradable wastes, Petroleum refineries.

The book attemps to determine: the quality of water we want to maintain in our watercourses, both surface and underground; the most efficient system of management measures for achieving the specified patterns of water quality and the best institutional or organizational arrangements for managing water quality. It makes use of the economic theory of resources allocation, and case studies of a number of actual situations are presented. The study begins by providing background information on some scientific and technological aspects of water quality. Major wastes, their effects and cost of treatment are analyzed, as well as factors influencing their generation. The theory of economic resource allocation as related to the problems of costs, value and public policy are discussed. A major section focuses on the concept of regional water quality management and the criteria for an economically optimal system of waste disposal. The experiences of some countries are outlined. The last section attempts to draw out the implications of points made for policy in the United States. (Murphy-Rutgers)
W70-01361

**REPLY ON COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',**
Oregon State Univ., Corvallis.
Joe B. Stevens.
Water Resources Research, Vol 5, No 4, p 908-909, August 1969. 2p, 2 ref.

Descriptors: *Water pollution control, *Water pollution, *Benefits, Fishing, Demand, Supply, Recreation demand, Social values, Costs, Pricing.
Identifiers: *Recreation benefits, Angler behavior, Consumer surplus, Willingness to pay, Gross social value, Net social value, Producers' surplus, Optimum pricing.

Stevens in this reply concedes that his attempt to separate supply and demand functions for anglers in his fishery case was unsuccessful. Having made certain amendments he suggests that the difference between his argument and Burt's is not great. As to the matter of gross or net measures of social value, Stevens claims that it all depends on when one deducts the costs of pollution control. Stevens is in basic agreement with Burt's suggestion that producers' surplus as well as consumers' surplus be considered in determining net social value of recreation resources. He suggests that the literature in the area is in need of an expanded form of the model which Burt presents. As an inducement for Burt to expand his model, Stevens poses three problems for consideration. The first is the meaning of producers surplus when government, rather than profit seekers, produces the service. Secondly, how is optimum pricing defined when the cost relationship in its marginal form is declining and approaches the quantity axis asymptotically. Third, under what conditions would consumers' plus producers' surplus overestimate the value of recreation resources relative to competing uses where market prices are more readily obtainable. The author, as an addendum, points out an error in his original article in his estimates of income elasticities. (Loeb-Rutgers)
W70-01373

**RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,**
Department of Health, Education, and Welfare, Philadelphia, Pa.
Robert V. Thomann.
Water Resources Research, Vol 1, No 3, p 349-359, Third Quarter 1965. 11p, 4 fig, 1 tab, 4 ref.

Descriptors: *Mathematical models, *Water pollution control, *Water pollution, Mathematical studies, Environment, Systems analysis, Dissolved oxygen, Water quality control, Water quality, Temperature.
Identifiers: *Delaware Estuary, External environment, Waste discharge.

This paper presents the basic principles involved in the construction of a mathematical model of dissolved oxygen in the Delaware Estuary. An attempt is made to introduce these principles with a minimum of mathematics and then to indicate how the mathematical model can be used to generate useful water quality control information. As such, the basic concepts of systems analysis and optimum (least-cost) water pollution control are presented. The basic motivation for the approach is provided by the Public Health Services' Delaware Estuary Comprehensive Study. This investigation is charged with developing a comprehensive water pollution control plan for water quality improvement in the Delaware Estuary. The basic objectives of formulating the Delaware system in mathematical terms were (1) to develop an evaluation of the cause and effect relationships between the external environment and the quality of water and (2) to utilize a portion of this evaluation to develop a rational approach to the attainment of various water quality goals. Both these objectives are indispensable to the techniques of comprehensive planning. (Loeb-Rutgers)
W70-01380

**STUDIES ON THE LONGITUDINAL MIXING IN OPEN CHANNELS AND ITS EFFECT ON THE RATE OF THE B.O.D. REACTION IN AQUEOUS MEDIA (IN CZECH),**
Hydraulic Research Inst., Prague (Czechoslovakia).
A. Nejedly, and J. Pelz.
Summaries in English and Russian. Vyzkumny ustav vodohospodarksy, Prace a studie, No 112, 1964. 116 p.

Descriptors: *Mixing, *Biochemical oxygen demand, Self-purification, Turbulence, Biochemistry, Decomposing organic matter, Laminar flow, Turbulent flow, Velocity, Flumes, Laboratory tests, Hydraulics equipment, Hydraulic models.
Identifiers: Longitudinal mixing.

It is pointed out that high values of the deoxygenation coefficient occur not only in small streams but also in large rivers. Therefore, the approach utilizing the indirect relationship of the deoxygenation coefficient to the depth of water is not generally valid. The authors submit their own proposal for a possible explanation of the difference between the rate of the BOD reaction under laboratory and field conditions. Under laboratory conditions, all particles of the aqueous medium are subjected to incubation simultaneously and for the same duration of time and therefore cannot interact. The unlimited body of water under stream conditions is subjected to longitudinal mixing by which particles of water containing organic matter in different states of biochemical change and organisms in different states of development can interact. Longitudinal mixing was simulated under laboratory conditions interact. Longitudinal mixing was simulated under laboratory conditions by mixing samples with different ages of incubation. The results proved the assumption. The study also included a hydraulic explanation of longitudinal mixing which was characterized by the dimensionless number, (increment of dispersion)/ (increment of mean detention period). The behavior of this parameter as ascertained in laboratory flume tests is very similar to the BOD decomposition rate changes as stated above. (Novotny-Vanderbilt)
W70-01381

**WIND INFLUENCE UPON COOLING WATER CIRCULATION,**
Waterloopkundig Laboratorium, Delft (Netherlands).
G. Abraham, and R. Koudstaal.
Journal of Power Division, ASCE, Vol 95, No PO1, p 63-75, Mar 1969. 6 fig, 4 tab.

Descriptors: *Electric power production, *Water cooling, *Winds, Flow, Temperature.

A field investigation performed in a cooling water circuit formed by a wide canal of an existing power plant shows the important influence of wind upon cooling water circulation. With the aid of measured float tracts a coefficient n could be estimated indicating which part of the cooling water, leaving the outlet channel is flowing directly to the inlet channels. The coefficient n can be found by the relationship (T sub in) - (T sub o)= (n/ (1 - n)) (T sub A - T sub in) where T sub in is the temperature of the cooling water in the plant directly behind the inlet, T sub o is the background temperature, T sub A is the temperature at some point A which can be found by (T sub A)= 1 - (Q sub ex/Q sub c) (T sub in+ delta T)+ (Q sub ex/Q sub c) T sub o where Q sub ex is the quantity of water exchanged through the interface, delta T is the rise in temperature of cooling water within the plant and Q sub c is quantity of cooling water discharged per unit time. Values of n of 0.4 to 0.7 have been found. For the power plant under consideration the relationship was compared with available records of the inlet

temperature. An adequate starting point was given to determine if the existing power plant can be enlarged without creating difficult conditions for the supply of cooling water. (Upadhyaya-Vanderbilt)
W70-01394

**CHEMICAL POLLUTION OF THE SEA AND THE LAW (FRENCH),**
Montpellier Univ. (France). Faculte de Droit.
J. P. Queneudec.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 217-230, 1969. 19 ref.

Descriptors: *Legal aspects, *Oil, *Water pollution, *Water pollution sources, Oceans, Ships.
Identifiers: Oil spills, Underwater oil deposits, Hydrocarbons.

Without being completely neglected, chemical substances which pollute the oceans have until the present been the occasion for the establishment of few laws, except in the case of the hydrocarbons. Pollution by hydrocarbons has been the object of detailed national and international rules covering pollution from both the cleaning of tanks on ships and the exploitation of underwater oil deposits. The author notes that the pollution from underwater oil wells is more easily dealt with by the law than oil waste from ships because of the traditional liberty of the high seas. (Tyner-Washington)
W70-01473

**MINERALIZED SPRINGS AND THEIR EFFECT ON UTAH'S WATER SUPPLIES,**
Utah Water Research Lab., Logan.
J. H. Milligan.
In: Groundwater Development in Arid Basins - Symposium, Utah State University, 1967, Proceedings. Utah State University, Logan, p 43-50, 1967. 8 p, 2 fig, 11 ref.

Descriptors: *Impaired water quality, *Streams, *Groundwater, *Water quality control, *Springs, Salinity, Great Basin, Irrigation, Utah, Water mangement, Mineral water.
Identifiers: *Marine sediments.

The study's objectives were to inventory Utah's highly mineralized springs, their quantities and qualities, and to determine their potential contaminating effect on regular water supply and possible means of control. A good water supply can be reduced just as effectively by lowering its quality as by reducing its quantity. Most of the mineralized springs lie in the Great Basin and are associated with major fault patterns. They bring dissolved salts to the surface from old marine sediments which antedate more recent uplifting and folding. Water from some of these springs merely spreads out over the desert, evaporates and leaves dry salt beds. Others flow into surface streams, thus lowering the quality. Fortunately, only a few of the springs sampled seriously impaired the quality of surface water supplies. However, it is conjectured that these may also be an unknown effect on groundwater supplies. The effect on surface waters is likely to increase as more water is diverted for use above the springs. The construction of dams to control the flow of important surface waters could help control the rate of contamination during the irrigation season. (Crouse-Arizona)
W70-01486

**CRAZED RESIN FILTRATION OF COMBINED SEWER OVERFLOWS.**
Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.

Water Pollution Control Research Series, DAST-4, Oct 1968. 78 p, 19 tab, 26 fig, 14 ref, 2 append. FWPCA Program 11020, Contract No 14-12-39. Available from the Clearinghouse as PB 187 867, $3.00 in paper copy, $0.65 in microfiche.

Descriptors: Pollution control, Pre-treatment (Water), *Filters, *Filtration, Separation techniques.
Identifiers: *Resin, *Crazing, Volume Reduction, Pollutant Concentration.

The feasibility of developing a self-cleaning, self-adjusting filtering device constructed of cylindrical structures of fibers laid down in predetermined patterns by a winding process and bonded in place by resins was investigated. The permeability of the structure is imparted by a mechanical cracking of crazing of the resin. Filtration runs showed a 62 percent reduction of suspended solids in the filtrate. However, sustained runs could not be realized. The self-cleaning aspect was not demonstrated.
W70-01487

**REDUCTION OF GROUNDWATER INFILTRATION INTO SEWERS BY ZONE PUMPING AT MERIDIAN, IDAHO.**
Hoffmann and Fiske, Boise, Idaho.

Water Pollution Control Research Series DAST-9, 1969. 28 p, 13 fig. Available from the Clearinghouse as PB 187 868, $3.00 in paper copy, $0.65 in microfiche. FWPCA Program 11020, Grant 29-IDA-2.

Descriptors: *Infiltration.
Identifiers: Volume reduction, Surcharging, *Zone-pumping, *Groundwater infiltration.

The reduction was investigated of goundwater infiltration into sanitary sewers by pump down of the water table in the sewer area assuming the geology, precipitation and local irrigation practices were ameanable to rapid and wide zones of influence. The water table was lowered below the sewer and reduced the volume of flow to the treatment plant. The water table was not lowered uniformly. For 140 square blocks 70 pump units would be required at an average cost of $40,000 per unit with a total power bill of $122.50 per day. This is not economically favorable when compared with other corrective measures.
W70-01489

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01585

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01586

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01587

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01588

**WATER POLLUTION CONTROL.**

Ky Rev Stat Ann secs 220.580-220.990 (1963).

Descriptors: *Kentucky, *Water pollution control, *Water conservation, *Water pollution, Waste disposal, Legislation, Legal aspects, Rivers, Streams, Administrative agencies, Sewage, Industrial wastes, Wastes, Water supply, Treatment facilities, Administration, Federal government, Investigations, Specifications, Permits, Regulation, Pollution abatement.
Identifiers: *Water quality standards, Penalties (Criminal).

Included among the terms defined relative to water pollution control are water, pollution, sewage, industrial wastes, other wastes, sewer system, treatment works, and disposal system. It is the declared policy of the state to conserve the state's waters for specified purposes, to provide an effective program of pollution control and to provide for cooperation with state and federal agencies in carrying out the foregoing objectives. The Water Pollution Control Commission is created to carry out the provisions of this act, and its administration is provided for. Included among the specified powers and duties of the Commission are those of: (1) supervising the administration of this act; (2) developing a pollution control program; (3) implementing the program once it is developed; (4) setting water quality standards; (5) adopting regulations necessary to accomplishing the purposes of this act; (6) issuing permits for waste discharge; and (7) enforcing the provisions of this act and regulations adopted hereunder. The Commission is further authorized to perform certain acts to secure to the state the benefits of the Federal Water Pollution Control Act. It is made unlawful for any person to discharge waste into state waters in contravention of the Commission's water quality standards or to do so without a Commission permit. (Keith-Florida)
W70-01589

**WATER POLLUTION CONTROL.**

Ky Rev Stat Ann secs 220.580-220.600 (1963)

Descriptors: *Kentucky, *Water pollution control, *Water conservation, *Water pollution, Waste disposal, Legislation, Legal aspects, Administrative agencies, Rivers, Streams, Lakes, Ponds, Reservoirs, Springs, Water wells, Marshes, Surface waters, Subsurface waters, Sewage, Water supply, Water conservation, Wildlife, Recreation, Pollution abatement, Administration, Federal government.
Identifiers: *Pollution prevention.

For the purposes of this act the following terms are defined in the following manner: 'water' means all rivers, streams, creeks, lakes, ponds, reservoirs, springs, wells, marshes, and other bodies of surface or underground water, natural or artificial; 'pollution' means the discharge of waste in such condition or quantity as may contaminate state waters to the detriment of any legitimate use; 'sewage' means water-carried human or animal wastes and industrial wastes; and 'disposal system' means a system of waste disposal. It is the declared policy of the state to: (1) conserve state waters for public water supplies, wildlife propagation, and for agricultural, industrial, recreational, and other legitimate uses; (2) provide a program for the prevention, abatement, and control of pollution; (3) provide effective means for the execution and enforcement of such a program; and (4) provide for cooperation among state and federal agencies in carrying out these objectives. It is the purpose of this act to safeguard from pollution the uncontaminated waters of the state, to prevent further pollution, and to abate existing pollution. The Water Pollution Control Commission is created for the purpose of carrying out the provisions of this act; its administration is expressly provided for. (Keith-Florida)
W70-01590

**WATER POLLUTION CONTROL.**

Ky Rev Stat Ann secs 220.610-220.990 (1963).

Descriptors: *Kentucky, *Water pollution control, *Waste disposal, *Water pollution, Legislation, Legal aspects, Administrative agencies, Treatment facilities, Water conservation, Pollution abatement, Administration, Federal government, Investigations, Research and development, Construction, Specifications, Permits, Jurisdiction, Regulation, Financing, Supervisory control (Power).
Identifiers: *Water quality standards, *Pollution prevention, Penalties (Criminal).

The Water Pollution Control Commission is empowered to: (1) supervise the administration and enforcement of this act and regulations promulgated hereunder; (2) develop a program for the prevention, control, and abatement of water pollution; (3) encourage and conduct studies, investigations, research, and demonstrations to enable it to

disseminate information relating to water pollution; (4) establish water quality standards for waters according to their particular uses; (5) adopt regulations for the prevention, abatement, and control of pollution as it deems necessary for the accomplishment of the purposes of this act; (6) issue permits for the discharge of wastes and for the operation of disposal systems and treatment works; (7) pass on all plans and specifications for the construction of proposed systems and works; and (8) take such action as is necessary to secure to the state the benefits of the Federal Water Pollution Control Act including cooperation, fund acquisition, project approval, and participation in federal programs. It is unlawful for any person to discharge wastes without a permit or to construct a disposal system without a permit. The Commission holds public hearings before adopting regulations of general applicability; the manner in which such hearings will be conducted is set out. (Keith-Florida)
W70-01591

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01593

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01594

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01595

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01596

**INCORPORATION OF SANITATION DISTRICTS.**

Va Code Ann secs 21-154, 21-168, 21-175 (1960).

Descriptors: *Virginia, *Tidal waters, *Water pollution control, Public health, Water pollution effects, Pollutants, Disposal, Environmental sanitation, Impaired water quality, Treatment facilities, Legal aspects, Legislation, Surveys, Investigations, Supervisory control (Power), Water pollution treatment, Pollution abatement.

Each sanitation district heretofore or hereafter created in the state is incorporated by this act and shall be known as a commission. Each commission has all the powers of a private corporation. In addition, each commission has as its primary purposes the protection of state tidewaters from pollution and the improvement of conditions affecting the public health and natural oyster beds, rocks, and shoals. Each commission may enter on any lands or waters for the purpose of making surveys, borings, soundings, or other examinations and may make and enforce rules or regulations for conducting its affairs. The State Health Commissioner must approve any method used by the commission for treating and disposing of sewage and industrial wastes so as to prevent the pollution of the tidal waters of the district. (Kelly-Florida)
W70-01608

**PUBLIC UTILITIES AND POLLUTION PREVENTION.**
Va Code Ann secs 15.1-292, 15.1-301, 15.1-307, 15.1-318, 15.1-320, 15.1-333 (1964), as amended, (Supp 1968).

Descriptors: *Virginia, *Public utilities, *Water pollution control, *Leases, Cities, Local governments, Governments, Water supply, Water works, Utilities, Electric power, Condemnation, Right-of-way, Ducts, Electrical power production, Powerplants, Disposal, Contracts, Sewage disposal, Ventilation, Pumping plants, Treatment facilities, Sewers, Pollution abatement, Water pollution, Water pollution sources, Costs, Sanitary engineering.

The governing body of every county, city, and town may acquire or establish water works, gas works, electric plants, sewage disposal systems, and other public utilities and may acquire the land and rights of way necessary for such purpose. Such governing body may also prevent water pollution by construction of drains, sewers, and public ducts. Absent public sewers, any landowner may establish and maintain a sewer from his land, along any public way, to the nearest natural watercourse. No rights of any city or town to its water front property, gas, water, and electric works shall be sold except by special ordinance. No lease of such public property shall be granted for more than thirty years. Any such lease may provide that upon termination the plant as well as the property shall become the property of the city or town. Any two or more counties, cities, or towns may enter agreements concerning sewers, pumping stations, ventilation stations, treatment plants, or any other such works. (Smith-Florida)
W70-01622

**WATER POLLUTION CONTROL BY MUNICIPALITIES.**
Va Code Ann secs 15.1-854 thru 15.1-856, 15.1-858, 15.1-867 (1964).

Descriptors: *Virginia, *Water pollution control, *Regulation, *Local governments, Cities, Governments, Inspection, Water supply, Water distribution (Applied), Water transfer, Sewers, Sanitary engineering, Culverts, Drains, Sewerage, Septic tanks, Swimming pools, Lakes, Pollution abatement, Water pollution, Sources, Diseases, Weeds, Snow, Stagnant water, Costs, Municipal water, Legislation, Supervisory control (Power).

A municipal corporation may regulate and inspect the following, whether public or private: water supplies; the production, preparation, transmission and distribution of water; the sanitation of systems, facilities and equipment which produce, prepare, transmit or distribute water; sewers; culverts; drains; sewerage; disposal and treatment systems; septic tanks; swimming pools; lakes; and other natural or artificial waters operated by clubs and associations. Such municipal corporation may adopt regulations deemed necessary to prevent the pollution of public or private waters, to prevent the transmission or distribution of impure water, to require the use of septic tanks where sewers are not available, to prevent the operation of sewers and drains which may cause pollution or the spread of disease, and to prevent the use of swimming pools or lakes when such waters are found to be polluted or dangerous. A municipal corporation may compel the abatement or removal of all nuisances from private or public property including weeds, snow, unsanitary or unhealthy substances allowed to accumulate, stagnant water and unsanitary structures. If the owner fails to so remove any nuisance, the municipal corporation may do so at the owner's expense. (Smith-Florida)
W70-01624

**FEDERAL ROLE IN POLLUTION CONTROL,**
James L. Agee.
Amer Water Works Assoc J, vol 61, no 10, p 499-503, Oct 1969, 5 p.

Descriptors: *Water pollution control, *Water quality, *Waste disposal, *Waste treatment, Legal aspects, Federal government, Administrative agencies, Water supply, Potable water, Public health, Sewage treatment, Construction, Reservoirs, Water Quality Act, Legislation, Financing, River basins, Investigations, Industrial wastes, Thermal pollution, Permits, Watersheds (Basins), Water pollution effects, Standards, Water utilization, Interstate rivers.

The pollution control concept has broadened from protection against public health hazards alone to an awareness that water is polluted and that action is needed whenever any of man's desired water uses are inhibited by its quality. This expansion began with the Federal Water Pollution Control Act of 1956, which provided for research and training. It continued with passage of the 1965 Water Quality Act which required the establishment of water quality standards on all interstate waters. This expansion culminated in the Clean Waters Restoration Act of 1966, which provided financing to achieve the goal of clean water. The agency organizational changes which have accompanied this expanding concept are noted. The purpose of the federal effort is to enhance the quality and value of our nation's water resources through the prevention, control, and abatement of water pollution. Examples are given of how this purpose is manifested in federal policy: quality standards should be designed to enhance the quality of water; all waste discharged should receive best practicable treatment; and water whose quality exceeds the standards should not be degraded arbitrarily. Current issues in and proposed legislation regarding pollution control are discussed; several new technical developments in the field are divulged. (Keith-Florida)
W70-01625

# 06. WATER RESOURCES PLANNING

## 6A. Techniques of Planning

**ATLANTIC STATES MARINE FISHERIES COMPACT.**
For primary bibliographic entry see Field 06E.
W70-01318

**ECONOMIC ANALYSIS IN THE ALLOCATION OF THE FEDERAL BUDGET TO RESOURCE DEVELOPMENT,**
Arizona Univ., Tucson.
M. M. Kelso.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 56-81, 1964. 26 p, 28 ref.

Descriptors: *Water resource development, *Benefits, *Costs, *Budgeting, *Welfare economics, *GNP, *Cost allocation, Economic evaluation, Economic analysis, Taxes, Economic efficiency, Government supports, Watershed, Prices, Input-output analysis, Risks, Irrigation.
Identifiers: *Decision making, Maximized dollar value, Net gains, Flood Control Act.

This article examines the present stage in the developments of defining and organizing the concepts and measurements needed in water resource development at the Federal level. Covered under this category are almost all federal water and watershed development proposals by combinations of congressional and agency practice. It is proposed that in economic evaluation among alternative projects, a welfare maximum is unattainable. Such alternatives may be ordered by way of the criterion 'enhancement of national income,' which is, in turn, an outcome of enhancement of economic efficiency. An appropriate model to serve the needs of the criteria of benefits and costs must include the present worth of net gains, the restraints on federal funds, the opportunity costs of federal funds, and some value for 'pure benefits'. In addition, the model will include such elements as measurement, market prices, imputed values, uncertainty, the rate of discount, and net prime benefits values. Financial and budgetary restraints are included from the viewpoint of opportunity costs in their

relation to federal resource policy. (Murphy-Rutgers)
W70-01346

**STATE AND LOCAL GOVERNMENTS AND THEIR BUDGET CONSTRAINT,**
Board of Governors of the Federal Reserve System, Washington, D.C.
For primary bibliographic entry see Field 06C.
W70-01353

**FISCAL POLICY AND EFFECTS OF GOVERNMENT PURCHASES: AN INPUT-OUTPUT ANALYSIS,**
Wayne State Univ., Detroit, Mich.
Karl W. Roskamp.
Public Finance, Vol 24, No 1, p 33-47, 1969. 15 p, 4 tab.

Descriptors: *Input-output analysis, Expenditures, Leontief models, Taxes.
Identifiers: *Fiscal policy, *Government purchases, Walrasian general equilibrium, Short run policy, West Germany, Budget balance, Factor incomes, Income effects.

In this paper an effort is made to trace the effects of changes in the composition of government expenditures given the structure of production of an economy. The author's particular interest is in the effects of changes in government purchases of goods and services. Ideally this topic should be studied at the micro level. It would be desirable to investigate the effects of government purchases on individual firms and households. The Walrasian general equilibrium system would be the suitable framework for such a study. However, such a system is not operational and due to its size and complexity it cannot be handled with the available computing facilities. The author makes use of a more aggregate but operational model, the Leontief input-output model. The Leontief input-output model reflects the inter-industry relationships of an economy. If the model is sufficiently large it can provide detailed information on direct and indirect effects of fiscal measures which should be useful for short run policy purposes. This type of model who adopted to investigate the effects of changes in government purchases. Such types of models have long been used in the water area. Recently, they have been incorporated in studies dealing with water in the Western states and the economic effects of changes in 'the water sector' via government investment decisions can be traced. (Loeb-Rutgers)
W70-01356

**AN EMPIRICAL TEST FOR DECISION RULE,**
Michigan State Univ., East Lansing.
Frances M. Magrabi.
Journal of Consumer Affairs, Vol 3, No 1, p 41-51, Summer 1969. 11p, 2 tab, 6 ref.

Descriptors: *Decision making, *Planning, Project planning, Economic justification.
Identifiers: *Decision rule, Decision model, Lexicographic ordering, Choice.

This paper describes a study undertaken for the purpose of identifying decision rules which are consistent with actual choice. A model of a partial decision system was formulated which included a specification of the elements of the system and the source of their properties. However, it left unspecified those which could convert it into a closed system, that is, one in which choice of an element is a logical consequence. Choice was then made to depend on a decision rule, for which omitted relationships could be inferred. On the basis of some assumptions concerning relevant dimensions and their appropriate scales for measurement, a test was constructed in which some inferences concerning the decision rule could be made from the choices of respondents. In the first section the decision model is stated; in the second section the instrument used in collecting data is described. Section three summarizes conclusions and points out some implications of the results with respect to the model. Such models might be applied to the water area to aid in planning and investment decisions in the context of selecting projects on the basis of benefit-cost criteria. (Loeb-Rutgers)
W70-01368

**RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,**
Department of Health, Education, and Welfare, Philadelphia, Pa.
For primary bibliographic entry see Field 05G.
W70-01380

## 6B. Evaluation Process

**STATISTICAL EVALUATIONS OF A CLOUD-SEEDING PROGRAM AT THE STREAMFLOW CONTROL LEVEL,**
Washington State Univ., Pullman. Coll. of Economics and Business; and Washington Water Research Center, Pullman.
For primary bibliographic entry see Field 03B.
W70-01247

**ATLANTIC STATES MARINE FISHERIES COMPACT.**
For primary bibliographic entry see Field 06E.
W70-01336

**CHOICE OF ADJUSTMENT TO FLOODS,**
Chicago Univ., Ill.
Gilbert F. White.
Chicago, University of Chicago, 1964. 150 p.

Descriptors: *Flood plains, *Management, *Planning, Technical feasibility, Economic efficiency, Timing, Flood damage, Interest rates, Costs, Benefits, Capital, Flood proofing, Insurance, Cost-benefit analysis, Cost sharing, Land use, Flood protection.
Identifiers: *Flood adjustments, *La Follette (Tenn), Social benefits, Stage-demand curves.

This is an examination of conditions in which managers of flood plain property chose among eight possible adjustments to floods. Factors affecting the path which adjustment takes are analyzed along with the technical feasibility of each. A detailed analysis is given to evaluating the economic efficiency of each adjustment process for different interest rates and flood frequency assumptions. Net benefits, residual losses plus costs, cost-benefit ratios and operating capital ratios are computed for the various adjustments. The differences between public and private adjustments and the importance of timing are also evaluated. It was found that there were few regularities in the choices preferred by private managers. The character of the decision made by the private manager is guided by three different factors and methods are suggested in which the community can affect these factors in order to reduce flood losses. (Loeb-Rutgers)
W70-01341

**ECONOMIC EVALUATION OF LAND DRAINAGE WORKS,**
Trent River Authority (Gt. Brit.).
M. Nixon.
River Engineering and Water Conservation Works, edited by R B Thorn, London, Butterworth and Co, Ltd., p 47-51, 1966. 5 p, 6 ref.

Descriptors: *Land-drainage works, *Economic evaluation, *Cost-benefit analysis, Costs, Decision-making, Maintenance costs, Capital, Indirect benefits, Intangible benefits, Flood damage, Economic life, Monetary value, Flood protection, Conservation.
Identifiers: *National interests.

The five objectives of land drainage works are given followed by an explanation of the direct and indirect benefits associated with such a project. The concept of the cost/benefit ratio in economic evaluation is explained. This necessitates a monetary assessment of the accruing benefits which calls for an understanding of the concept of economic life. The most economically sound way of assessing the benefits from land drainage works is presented for direct, indirect, and intangible benefits. Care should also be taken to include maintenance costs and the deficiencies of economic evaluations. Related to this last point, arguments against the use of cost-benefit analysis are presented. (Murphy-Rutgers)
W70-01342

**ENGINEERING AND ECONOMICS IN PROJECT PLANNING,**
Stanford Univ., Calif.
Ray K. Linsley.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 93-103, 1964. 11 p, 4 fig, 6 ref.

Descriptors: *Engineering, *Economics, *Project planning, *Irrigation, *Frequency analysis, *Risks, *Statistics, Safety, Economic efficiency, Costs, Benefits, River basins, Flood control, Time, Random process, Dams spillways, Watersheds, Water quality.
Identifiers: *Climatic trend, Power projects.

This article views engineering and economics as the essential features of project planning. Effective engineering will result in satisfying the requirements of safety, efficiency, economy, and esthetics. Engineering design techniques and economic principles are discussed as applied to water-project planning. In this planning there are substantial differences in costs and benefits among equally acceptable designs. Equal uncertainties exist in the evaluation of the economic consequences of these projects. A systematic approach is called for in analyzing the various principles of design in water projects to assure that all possible alternatives are considered. Basic data must be collected on all aspects of water planning and better use must be made of this data. Research programs and education programs in new methodology are urgently needed to fulfill these goals. All project evaluation should include analysis of the probable effect of unavoidable uncertainties on the relation of benefit to cost to insure that the final decision on feasibility is made with complete knowledge of the probability that the decision could be wrong. (Murphy-Rutgers)
W70-01344

**RATIONAL CHOICES IN WATER RESOURCES PLANNING,**
Stanford Univ., Calif.
Hubert Marshall.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 403-423, 1964. 21 p, 38 ref.

Descriptors: *Planning, *Decision making, *Economic analysis, *Risks, *Interest rate, *Economic efficiency, *Water resources development, Investment, Income, Cost-benefit analysis, Dams, Floods, River basins, Erosion, Navigation, Taxes, Optimization, Value.
Identifiers: *Rational choice, *Balance of interest, Power output.

This article deals with the model of rational choice in decision-making in water resources planning. The ideal of such a model calls for value identification, value-ranking, identification of alternatives, consequences of all alternatives, and evaluation of the consequences in terms of the identified values. The theory behind this model is that knowledge contributes to the likelihood of viable decision. Economic analysis contributes heavily to this decision-making process in the high ranking of

economic consequences. Economic information lessens the area of uncertainty. Such information can also cast light on conflicts over competing and mutually exclusive uses and on the economic motives of interest groups that play an important part in decision-making. Economic analysis can also indicate the economic consequences of letting nonmarket criteria dominate the decision-making process, and thus contribute to the rationality of this process by furthering the adequacy of the decision-maker's knowledge in water resources planning. (Murphy-Rutgers)
W70-01347

**PROMISES AND HAZARDS OF MAN'S ADAPTABILITY,**
Rockefeller Univ., New York.
Rene Dubos.
Environmental Quality in a Growing Economy, edited by H Jarrett, Baltimore, The Johns Hopkins Press, p 23-40, 1966. 17 p.

Descriptors: *Environment, *Genetics, *Diversification, Human diseases, Pollutants, Economics, Smog, Water pollution, Population, Public health, Technology, Cities, Efficiencies.
Identifiers: *Socio-cultural processes, *Adaptability, *Human traits, Mutation, Malnutrition medicated survival, Prosperity, Biological past, Frontiers.

This article deals with man's ability to live under 'unnatural' conditions, or environmental changes. Animals adapt to these changes through genetic change, whereas man's genetic structure remains basically unchanged. Technological civilization can survive only if it takes cognizance of these fundamental biological attributes of mankind which are essentially unchangeable. The goal of technology, however, should not be to provide man with a sheltered environment in which he is protected from trauma, for certain traits in man's nature cannot develop normally or remain healthy without constant stimulation and challenge. The monotony of technological culture can eliminate human traits, at least in their phenotypic expression. To avoid this, a deliberate effort should be made to create and maintain as diversified an environment as possible, even at the expense of efficiency. This diversity should be a crucial test of true functionalism, since it is needed to bring out the unexpressed potentiality of mankind. Since water resources are an important aspect of environmental studies, and provide the basis for a diversified environment within the urbanizing society, this article can be of interest to water resource researchers. (Murphy-Rutgers)
W70-01350

**THE ECONOMIST AND THE ENGINEER: ECONOMIC DYNAMICS OF WATER RESOURCE DEVELOPMENT,**
Michigan Univ., Ann Arbor.
Kenneth Boulding.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa, Iowa State University Press, p 82-92, 1965. 11 p.

Descriptors: *Water resource development, *Engineering, Dams, Prices, Irrigation, Public utilities, Flood control, Flood plain, Government supports, Fixed costs, Resource allocation, Technology, Taxes, Income.
Identifiers: *Urban water supply, Bureau of Reclamation, Income distribution.

At present water resources are usually developed by engineers. However, there is much that the economist can contribute. The engineer is project oriented whereas the economist is system-oriented. The engineer is concerned with the physical construction of a project whereas the economist is concerned with the value attached to it relative to everything else. The biggest difference between the two is that the engineer considers the price system as given whereas the economists think of it as a variable open to change. With regard to public versus private development of water resources the author makes an argument for more private enterprise in this area. He then discusses the relative states of development in the water resource area. In line with this, the price structure performs the functions of allocating resources, distributing income, and directing technical change and should be used to regulate all three. These are some of the aspects of water resource development which the economist should make the engineer cognizant of. (Murphy-Rutgers)
W70-01352

**REGIONAL DEVELOPMENT AND THE WABASH BASIN,**
Illinois Univ., Urbana.
R. R. Boyce.
Urbana, Illinois University of Illinois Press, 1964. 218 p.

Descriptors: *Water resources development, *River basin development, *Recreation, Regional analysis industries, Political aspects, Water management, Transportation, Population employment, Agriculture, Technology, Wages, Flood damage, Reservoirs, Growth rates, Investment, Optimization.
Identifiers: *Wabash Basin, *Regional planning, Economic development, Differential growth, Industrial development, Delaware River Basin.

This book is a collection of essays by different authors. It is an attempt to explore some of the more fundamental questions of regional development within the realities of a specific area, the Wabash Basin. The book is organized into four main parts. Part one lays the foundation for the general discussion on regional development and change by providing specific information on the Wabash basin. Part two discusses the problems and prospects of regional development and change. First, a general national framework of regional change is presented and then the problems of effecting plans and determining policy are discussed. Part three is concerned with water and economic development. Both the nature of water resources as an initiator of regional change and the political and administrative framework required for such development are discussed. The final part of the book presents a possible model for optimum regional economic development. (Murphy-Rutgers)
W70-01354

**FISCAL POLICY AND EFFECTS OF GOVERNMENT PURCHASES: AN INPUT-OUTPUT ANALYSIS,**
Wayne State Univ., Detroit, Mich.
For primary bibliographic entry see Field 06A.
W70-01356

**UNIFICATION OF ENGINEERING ECONOMY: THE NEED AND A SUGGESTED APPROACH,**
Case Western Reserve Univ., Cleveland, Ohio.
Arnold Reisman.
The Engineering Economist, Vol 14, No 1, p 1-24, Fall 1968. 24 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Economics, *Investment, Time, Management, Sinking fund, Price, Salvage value, Payment, Interest, Costs, Income.
Identifiers: *General models, *Engineering economy, Economic analysis, Unification, Present worth, Annuity, Deferred annuity, Capital recovery, Time interval.

It is well recognized that human learning proceeds from the familiar to the less familiar and to the unknown, and from the particular to the general. In the theory of economic analysis, however, there is, at any given stage of development, much to be gained from an ability to proceed from the general to the particular. In the field of chemistry, Mendeleyev's periodic table removed many burdens from the students of chemistry and in a very straightforward fashion pointed the way to discovery of new elements. Mendeleyev developed this chart by reflecting on the work of others and achieving a synthesis that demonstrated a pattern and gave meaning to formerly unconnected elements. The author contends that the various fields of management science in general and the field of economic analysis in particular are now ripe for this kind of generalization. The author briefly describes a general model for investment analysis in the hope that this will convince researchers of the need of a synthesis in the fields of managerial and engineering economy. Accordingly, one may infer that such general models will be of aid in the water area in synthesizing complex investment and capital budgeting problems. (Loeb-Rutgers)
W70-01357

**THE EFFECT OF PROJECT LIFE DISPERSION ON KEY INTEREST FACTORS FOR ECONOMIC ANALYSES OF CAPITAL INVESTMENT,**
North Carolina State Univ., Raleigh.
John R. Canada, and Harrison M. Wadsworth.
The Engineering Economist, Vol 11, No 4, p 15-36, Summer 1966. 22 p, 12 fig, 7 ref, 1 append.

Descriptors: *Economics, *Investment, *Capital, Variability, Risks, Interest rate, Distribution patterns, Project life.
Identifiers: *Project life dispersion, Project worth, Expected value, Capital recovery factor, Present value factor, Normal distribution, Uniform distribution, Beta distribution.

There is little question that project life is an important element in determining the prospective worth or relative desirability of an investment project. The dispersion or variability which can occur in project life is a prime candidate for consideration whenever the effect of risk is taken into account in an economic analysis of a prospective project. This condition is due to the typically high degree of sensitivity of project worth, or relative desirability, to changes in project life. The purpose of this paper is to discuss the effect of the dispersion of the life of a project on expected values of two key factors in economic analyses. This analysis enables one to observe the relative effects of different life distribution shapes, distribution variances, and interest rates. At the same time, it is hoped that the graphical analysis presented will permit a better judgment of when it is worthwhile to explicitly consider the effect of high dispersion by calculating the expected value of one or both of these key factors. This analysis might aid the water researcher attempting to decide on the desirability of an investment project. (Loeb-Rutgers)
W70-01359

**AN ECONOMIC THEORY OF TECHNOLOGICAL CHANGE,**
Yale Univ., New Haven, Conn.
W. D. Nordhaus.
American Economic Review Vol LIX, No 2, p 18-28, May 1969. 11 p, 3 tab, 12 ref.

Descriptors: *Productivity, *Technology, *Interest rate, Capital, Labor, Monopoly, Consumption, Pricing, Costs, Equilibrium, Patients.
Identifiers: *Technological change, Maximum likelihood estimator, Entrepreneurs invention, Factors of production.

The article is an attempt to establish a reasonable model of the inventive process for the purpose of sorting out the sources of productivity change among the different factors of production. Technological change has largely been neglected in economic analysis. The author derives his model and incorporates it into the conventional neoclassical model of the economic system. The chief differences in the structures are found to be that technology can be interpreted in the growth equation as a capital good with unitary exponent and that the technology-formation function derived is quite different from the capital formation equation. The conclusions of the model are tested and it is found that patents are positively correlated with in-

creases in output but negatively correlated with the level of productivity. The hypothesis of a relation between the flow of patented inventions and the growth of productivity is not supported by the testing and subsequent explanations for this result are suggested. The obvious ramifications of changes in the production function to the water resource area make this article pertinent to the water resource planner. (Murphy-Rutgers)
W70-01360

**EVALUATION OF GOVERNMENT INVESTMENT PROJECTS,**
Illinois Univ., Urbana, Ill.; and Temple Univ., Philadelphia, Pa.
John Due, and W. Lynn Holmes.
Public Finance Vol XXII, No 3, p 255-263, Spring 1967, 9p.

Descriptors: *Investment, *Government, *Economic analysis, Interest rate, Capital, Mathematical studies, Value, Indirect benefits, Profits, Risks, Economic evaluation, Economic justification.
Identifiers: *Discounting-forward, *Earnings, *Rate of return, *Cumulative adjustment, Depreciation.

This article is concerned with the question of net returns from investment projects as a basis for investment decision-making by government. An evaluation of existing projects to determine if they were economically justifiable has the advantages of focusing attention on neglected problems and suggesting new approaches. The analysis performed is directly applicable to government investment projects whose indirect benefits may be estimated in monetary terms. This would include many investment projects in the water resources area. The elements to be used in evaluation are mentioned along with the problems common to different evaluation approaches. The four major methods of evaluation are considered, that is, the ascertainment of initial year value, the forward cumulation of earnings and investment to the terminal year, the use of cumulated forward-moving year-to-year adjustment and the calculation of the internal rate of return. The success of each in an empirical study is summarized. (Murphy-Rutgers)
W70-01365

**PRICING PIONEERING PRODUCTS,**
Joel Dean Associates, Inc., Hastings-On-Hudson, N.Y.
Joel Dean.
Journal of Industrial Economics, Vol 7, No 3, p 165-179, July 1969. 15p.

Descriptors: *Pricing, Demand, Costs, Competition, Prices, Investment, Monopoly.
Identifiers: *Pioneer products, Innovation, Monopoly pricing, Price range, Sales, Rate-of-return pricing, Skimming pricing, Penetration pricing promotion.

A pioneer product is defined here as one which incorporates a major innovation. Its market is therefore, at the outset, ill-defined, since potential applications cannot be foreseen with precision. Pricing decisions usually have to be made recognizing wide margins of error in the forecasts of demand, cost, and competitors' capabilities. The difficulty of pricing new products is enhanced by the dynamic deterioration of the competitive status of most new products, where market decay is speeded by the high rate of innovation. This condition makes the life cycle of a new product's economic status a strategic consideration in practical pricing. This paper is concerned with the level of price of the new product and not its price structure (i.e. the average price per pound of a good and not the structure of price differentials depending on quality-spreads, order-size, distribution-channel, geographical location, etc.). The author concludes with nine pricing precepts for new product lines. This paper may have relevance for pricing the water service products of water systems based on changing technology (without adapting profit maximizing goals as the criterion for the pricing schedule). (Loeb-Rutgers)
W70-01367

**WELFARE METHODOLOGY AND THE MULTI-BRANCH BUDGET,**
Dalhousie Univ., Halifax (Nova Scotia).
John G. Head.
Public Finance, Vol XXIII, No 4, p 405-424, 1968.

Descriptors: *Welfare economics, *Finance, *Ethics, *Political aspects, Income, Resource allocation, Employment, Taxes, Economic analysis, Budgeting, Optimization.
Identifiers: *Public finance, *Stability, Economic growth, Multi-purpose budget.

The author wishes to present a reexamination of the public finance framework. The article begins with a general discussion of the basic purposes which a welfare framework might be expected to serve. Included here is the study of a framework encompassing ethically-desirable policy proposals, a generally acceptable ordering of all economic situations, useful information for policy, and politically operational policy proposals. The author then attempts to clarify some apparent obscurities and inconsistencies in the standard formulation of the multi-branch budget. He shows that the problem of formulating and interpreting a framework of welfare objectives can be approached in any of the above manners and there is no reason that the primary emphasis should not be placed on one rather than another. Also, the main purpose to be served by the multi-branch budget of public finance theory needs to be interrupted in view of the purpose it is meant to serve. The importance of welfare economics in water resource development makes this article of interest to the water researcher. (Murphy-Rutgers)
W70-01369

**REPLY ON COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',**
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 05G.
W70-01373

**ON THE ACCURACY OF ECONOMIC OBSERVATIONS,**
Oskar Morgenstern.
Princeton, New Jersey, Princeton University Press, 1963. 322 p.

Descriptors: *National income, *Income, *Growth rates, *Economics, *Measurement, *Statistics, Statistical methods, Time, Stability, Decision making, Foreign trade, Prices, Statistical models, Mathematical models, Mathematical studies.
Identifiers: *Accuracy, *Economic observations, *Certainty, *Error, *Economic statistics, Data, Designed experiments, Information, Observers, Questionnaires.

This study is the preliminary result of a prolonged concern with the properties of economic data. The book addresses itself to both the general reader and the professional economist. The author states that the former will see that decisions made in business and in public service are based on data that are known with much less certainty than generally assumed by the public or the government. The second group will discover that even the most widely accepted figures frequently have error components of unexpected magnitude and consequently cast doubt on many currently accepted analyses of economics. The situation pertaining to the concern with the accuracy of measurement in the social sciences, as compared to the natural sciences, may not be simpler, but even if it should be, there exists no comparable tradition of exploring errors and evaluating their influence upon economic science and its application. However, when the true conditions are realized, more powerful and realistic theory can be evolved. The author contends that we must distinguish between what we think we know and what we really do and can know. The observations and general topic of this book would be of interest to the economist involved in the water area where economic data provide the basis for empirical studies. (Loeb-Rutgers)
W70-01376

**A NOTE ON LINEAR AGGREGATION OF ECONOMIC RELATIONS,**
Delhi Univ. (India).
P. N. Misra.
International Economic Review, Vol 10, No 2, p 247-249, June 1969. 3 p, 1 ref.

Descriptors: Regression analysis, *Economics, Statistical methods.
Identifiers: *Linear aggregation, Economic relations, Macro coefficients, Micro coefficients, Matrix auxiliary regressions.

In this note the author shows that the relationships between the macro and micro coefficients derived by Theil can be derived in a simple way if one adopts a slightly different approach to the aggregation problem. The author considers the case of aggregation over a set of individuals. It is supposed that the micro relations, corresponding to a given set of individuals, are the true underlying relations indicating the micro behavior of the individuals. Further, the author defines the macro variables as the unweighted aggregates of observations on the micro variables over the set of individuals. The macro relations are then derived by applying a suitable transformation to the micro relation. In the second section of this note the layout of the micro and macro relations in matrix form are given. In section three, the author derives the relationships between the macro and micro coefficients. Issues of the aggregation problem are relevant to the specification and interpretation of water demand and use functions. Aggregation should be an important concern of empirical water analysis where an attempt is made to test economic theory with water and economic variables. (Loeb-Rutgers)
W70-01377

**SEQUENTIAL PLANNING AND CONTINUAL PLANNING REVISION,**
California Univ., Berkeley.
Steven M. Goldman.
Journal of Political Economy, Vol 77, No 4, Part 2, p 653-664, August 1969. 12p, 9 fig, 6 ref.

Descriptors: *Planning, Welfare.
Identifiers: *Sequential planning, *Continual planning revision. *Current preferences, *Social preferences, Periodic revision, Planned economy, Consumption.

This paper investigates the behavior of a planned economy within the context of neoclassical growth theory. The author is concerned with the difficulties faced by an economy where the wishes of the current population may diverge from those of the society as a whole. The author distinguishes between the desires of the current population-current preferences and those of all individuals in the society, regardless of when they will live. Since the current population constitutes the only group capable of expressing its preferences and since the composition of this group is continually changing, plans once formulated may become immediately obsolete. This potential inconsistency may be resolved through a procedure of continual planning revision or may be permitted to persist through some portion of the plan. This type of planning requires that at each moment in time the then current population be free to select whatever future plan it desires and to begin the immediate implementation of this program. Sequential planning implies the ability of the planner to determine the course of the economy over the entire planning period. The author also considers an intermediate form of planning in which programs may be scrapped and new ones instituted at points in time

before the expiration of the original plan. The author is concerned with the analyses of finite economic programs (such as those in the water area) in the context of the various types of planning techniques described above. (Loeb-Rutgers)
W70-01378

**NATIONAL WATER RESOURCES ADMINISTRATION,**
Yale Univ., New Haven, Conn.
James W. Fesler.
Economics and Public Policy in Water Resource Development. Edited by S. C. Smith, and E. N. Castle. Ames, Iowa State University Press, p 368-402, 1964. 35 p, 114 ref.

Descriptors: *Federal government, *Water resources, *Planning, *Water supply, *Utilities, *Watersheds, Treatment facilities, Droughts, Water supply, Flood control, Construction, Irrigation, Navigation, Fishing, Pollution, Dams, River system, Harbors, Recreation, Reclamation, Electric power, Forests.
Identifiers: *Economic development, Organization.

This article discusses the organization of the federal government for water resources responsibilities. National water resources administration is assumed to be the only feasible solution to economic problems for which the only alternative solutions are a valley authority or a joint regional instrument of the states and the federal government. Congressional stubbornness has resulted in conflicting water resource policies and in a complicated structure of committees for water resources. A drainage basin plan has helped ease these problems by focusing on area economic difficulties. Planning, construction and operation of water resources programs and projects should be consolidated in one department and should include other resource bases of economic development such as coal, oil and gas. The planning problem branch should concentrate on relating water to other economic resources and human needs. The entire department should recognize water resources development as an integral part of economic development, thus calling for broad-natured review and decisions. (Murphy-Rutgers)
W70-01379

**THE LARGE PLANT CONCEPT,**
Kellogg M. W. Co., New York.
For primary bibliographic entry see Field 06C.
W70-01555

**PACIFIC SOUTHWEST WATER PLAN,**
Department of the Interior, Washington, D.C.
W. I. Palmer.
Published by US Dept of the Interior, Washington, Aug 1963. 250 p, 26 tab, 9 fig.
Identifiers: *Proposals, *Southwest United States, *Water conveyance, *Water utilization, Brackish water, Canals, Economic evaluations, Feasibility study, Regional planning, Water sources, Water storage.

A comprehensive report covering a water and related resources development plan for the lower Colorado River Basin and adjacent area. The report blueprints actions to develop facilities needed to meet present requirements under reduced ground-water overdrafts, plus future requirements of the region until about 1990. Phase 1 of the plan would cost $1.9 billion and would include bridge canyon and marble canyon dams and powerplants on the main stream of the Colorado River, enlargement of the California state water project aqueduct, the central Arizona project, the southern Nevada water supply project, the dixie project in southwestern Utah, the Hooker Dam project in New Mexico, expansion of Indian irrigation project facilities, water salvage and ground-water recovery projects, initial programs related to fish and wildlife, and a 50-mgd desalting plant on the seacoast. Phase 2 of the plan would include those additional units necessary to provide for essentially all of the additional water demands for the next 25 years. Construction would extend through the year 2006. Several alternative plans are outlined.
W70-01558

**SURVEY OF OPERATING EXPERIENCES UNDER NEW STATE WATER LAWS,**
George E. Ferguson, Harvey O. Banks, John C. Detweiler, and Robert M. Dixon.
Amer Water Works Assoc J, Vol 53, No 8, p 973-978, Aug 1961. 6 p, 2 ref.

Descriptors: *Administration, *Surveys, *Water law, *Water policy, Legal aspects, Legislation, Water resources, Surface waters, Groundwater, Water rights, Water pollution, Water resources development, Water conservation, Water supply, Droughts, Permits, Hydrologic aspects, Hydrologic data, Evaluation, Administrative agencies, Supervisory control (Power).
Identifiers: Flood prevention.

At least twenty-six states have enacted new water laws since 1955; over half of these states created new water agencies. Many of the new agencies are charged with administration of both surface and groundwater, and many have greater authority than the agency which they replaced. Droughts over many areas of the country prior to 1955 may have been a motivating factor in much of the new legislation. Though accounts of operating experience are rarely published, the task group learned through personal interviews that: (1) study groups to recommend needed legislation are widely used and appear to be effective; (2) water legislation is generally too detailed to permit the flexibility needed for the best results; (3) legislation which places the responsibility for the administration of all the water resources of a state in a single agency has proved most effective; (4) local participation in local planning, development, and management is needed; (5) administrators feel a need for adequate hydrologic, economic, and other scientific data; and (6) little could be learned regarding the matter of special rights to water by type of use. (Keith-Florida)
W70-01609

**DEVELOPMENT, CONSERVATION AND USE OF WATER RESOURCES.**

Va Code Ann secs 10-17.1 thru 10-17.9 (Supp 1968).

Descriptors: *Virginia, *Water resources development, *Administration, *Water conservation, Water resources, Water policy, Administrative agencies, Conservation, Governments, Natural resources, Planning, Resources, Regulation, Riparian rights, Beneficial use, Preferences (Water rights), Coordination, Management, Wildlife conservation, Groundwater, Water pollution control, Pollution abatement, Water pollution, Financing, Aquatic life, Recreation facilities, Legislation.

The Board of Conservation and Economic Development is assigned the responsibility for planning the development, conservation, and utilization of Virginia's water resources. After making a study of the existing water resources and the needs and methods of conservation, the Board shall formulate a coordinated policy for the use and control of the state's water resources. In creating such policy, consideration should be given to: protecting existing rights; providing an adequate and safe water supply; promoting watershed development; protecting wildlife and groundwater supplies from drainage; supporting aquatic life; insuring minimal pollution; and developing water recreation facilities. The Board shall resolve conflicts between state agencies as to water use. It may cooperate with all branches or agencies of the federal government or of any state government and may make technical advice and information on water resources available. In all conservation and water resource matters, the Board may speak for the state. The Board shall have the necessary financial powers to carry out its purpose. (Smith-Florida)
W70-01619

**PERMANENT JOINT COMMITTEE ON WATER RESOURCES.**
R I Gen Laws Ann secs 22-7.1-1, 22-7.1-3 thru 22-7.1-5 (1968).

Descriptors: *Rhode Island, *State governments, *Water resources development, *Investigations, Water policy, Water resources, Resource development, Conservation, Governments, Water conservation, Water control, Water supply, Water works, Water purification, Water districts, Administrative agencies, Administration, Water requirements, Resources, Distribution, Water rates, Water costs, Desalination, Pipelines, Pipes, Reservoirs, Recreation facilities, Domestic water, Industrial water, Legislation.

A Permanent Joint Committee of the General Assembly on Water Resources is created. Said joint Committee consults and counsels with the state Water Resources Coordinating Board, Water departments and water districts of other governmental bodies and agencies, and with agencies and quasi-municipal corporations dealing with development and operation of water supplies, water control structures, water works, purification plants, desalination methods and plants, water pipe lines, and distribution systems. Said Committee conducts a continuing study and review of water requirements, resources, supplies, methods of acquisition and distribution, and needs and resources of communities. The Committee investigates and desirability of merging water departments and companies, the feasibility of utilizing reservoirs for recreational purposes, and the reasonableness of water rates and charges. The Committee also periodically reports to the general assembly, making recommendations to assure adequate supplies of water for domestic, industrial, agricultural, and recreational use. Said Committee may contract for necessary technical advice. (Smith-Florida)
W70-01626

**THE RHODE ISLAND DEVELOPMENT COUNCIL.**
R I Gen Laws Ann sec 42-26-15 (1956).

Descriptors: *Rhode Island, *Resource development, *Surveys, *Natural resources, Maps, Resources, Land resources, Conservation, State governments, Governments, Administration, Administrative agencies, Planning, Legislation, Land use, Harbors, Water works, Highways, Water supply, Drainage, Flood control, Sewerage.

The Rhode Island Development Council is authorized to make maps for governmental agencies and to make planning studies and surveys for the collection of data pertaining to soil conditions, land use and classification, port, harbor and waterway work, highways, water supply, drainage, flood control, sewerage, and other matters involved in the physical development of the state or of any subdivision thereof. (Smith-Florida)
W70-01638

## 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**ECONOMICS OF PUBLIC WATER PRICING: THE CALIFORNIA CASE,**
California Univ., Berkeley.
Michael F. Brewer.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 222-247, 1964. 26 p, 51 ref.

Descriptors: *Water rights, *Pricing, *Economic efficiency, Water rates, Public utilities, Economic evaluation, Dams, Reservoirs, Irrigation, Water resource development, Water supply, Economic analysis, Water districts, Investment, Elasticity of demand.

Identifiers: *California Aqueduct, *Parameters, *Beneficiary payments, Benefit pricing, Marginal monetary utility, Perpetuity contracts.

This article deals with the development of relevant criteria and their application in the evaluation of specific pricing alternatives in public agencies' pricing practices, using water development as a model. Proposals of the state of California to construct, finance, and administer a statewide water development plan are used for illustrative purposes. The economic rationale of this water plan is inferred as the increase of net productivity of the state. Hence, although water development is given special individual attention, public resource developments are frequently integrated with general economic planning. This results in making the purposeful use of water a potentially prominent issue for research and practical implementation, since it is designed to induce particular patterns of population and economic activity. In anticipation of this potentiality, proposals for state pricing policy must be accommodating to future changes which will permit the integration of the California Water Plan into broader economic planning. Perpetuity contracts seem inappropriate to these goals, whereas service by the state would render receipts available for public reinvestment and additional outlays for the plan. (Murphy-Rutgers)
W70-01345

**ECONOMIC ANALYSIS IN THE ALLOCATION OF THE FEDERAL BUDGET TO RESOURCE DEVELOPMENT,**
Arizona Univ., Tucson.
For primary bibliographic entry see Field 06A.
W70-01346

**STATE AND LOCAL GOVERNMENTS AND THEIR BUDGET CONSTRAINT,**
Board of Governors of the Federal Reserve System, Washington, D.C.
Edward M. Gramlich.
International Economic Review, Vol 10, No 2, p 163-182, June 1969. 20 p, 3 tab, 15 ref.

Descriptors: *Budgeting, *State governments, *Local governments, Credit, Expenditures, Income, Statistical methods, Model studies, Taxes, Gross National Product, Interest rate, Capital, Debt, Regression analysis.
Identifiers: *Budget constraint, *Budgets, Econometrics, External forces, Grants-in-aid, National accounts budget.

Econometric models have probed many previously unexplored areas of the United States economy. However, there is one sector still relatively untouched by model-builders, and strangely enough, it is a sector which today is generating some of the most heated political controversy, that is, the area of state and local governments. Although there have been many analyses of certain aspects of state and local behavior (both institutional and econometric) on both a micro and a macroeconomic level, none of these analysis have adequately considered the budget constraint under which states and localities operate. These governmental units are generally required to balance their current operating budgets, and they must pay a default risk premium when they make use of credit markets. State and local expenditure and revenue items cannot be analyzed in isolation. The research approach must permit expenditure and revenue policies to be formulated simultaneously and allow them to have mutual ramifications. This study attempts to build such a budget constraint into behavioral descriptions of the components of state and local budgets. The budget constraint proves to have an important effect on the method by which state and local budgets respond to external forces such as movements in GNP, interest rates, and federal grants-in-aid. The paper then presents a statistical estimate of the budget constraint model. Since these governmental bodies are involved in water investment and development projects, this analysis of the role of budget constraints provides the water researchers with insights into effects of macro variables on the water area. (Loeb-Rutgers)
W70-01353

**THE LOGIC AND MATHEMATICS OF NON-ANNUAL COMPOUNDING APPLIED TO INVESTMENT DECISIONS,**
Michigan Univ., Ann Arbor.
Harry Benford.
The Engineering Economist, Vol 12, No 2, p 67-92, Winter 1967. 26p, 7 fig, 1 tab.

Descriptors: *Mathematical studies, Investment, Interest, Interest rate, Return, Debt.
Identifiers: *Non-annual compounding, *Investment decision, Compound interest.

The author suggests that many of us have grown so used to living with compound interest that we have forgotten its underlying principles. In particular, those who deal in long term investment decisions often grow too accustomed to the simplifying assumption of annual compounding. When confronted with situations in which non-annual compounding must be understood, we often find ourselves confused. The purpose of this paper is to stimulate clear thinking about non-annual compounding and to suggest when and where it may apply. An economic analyst, the author contends, should be able to deal in both nominal and effective interest rates. He should understand how to handle both discrete and continuous returns, and how to find their equivalent interest rates based on annual compounding. This paper should prove valuable to the water researcher involved in the investment decision making process with the associated problems of rate of return, present value of benefits and capital budgeting. (Loeb-Rutgers)
W70-01362

**SHARING FINANCIAL RESPONSIBILITY OF RIVER BASIN DEVELOPMENT,**
Department of Agriculture, Washington, D.C. Resource Development Economics Div.
M. M. Regan.
Economics and Public Policy in Water Resource Development. Edited by S. C. Smith, and E. N. Castle. Ames, Iowa, State University Press, p 209-221, 1965. 13 p, 10 ref.

Descriptors: *River basin development, *Costs, Direct benefits, Indirect benefits, Capital, Cost-sharing, Cost-benefit analysis, Cost repayment, Economic justification, Project benefits, Project costs, Cost allocation, Rivers, Government.
Identifiers: *Financial responsibility, International rivers.

Sharing financial responsibility of river-basin development involves division of project and program costs among purposes, interests, groups and individuals. These have to be divided between primary and secondary beneficiaries, state or local governments and the national public. This article centers primarily on the approaches, guides and problems involved in the division of project costs among interests and participants. Thus, the objectives to be served and the merits and limitations of alternative basic approaches for apportioning charges or assessments are studied as well as the adjustments and modifications necessitated by problems of practical application and acceptability. The author recommends that requirements be established to serve more specific objectives than is presently the case to achieve optimum resource development and use and to promote desired incidence, distribution and stabilization policies. In establishing requirements for most project purposes, greater emphasis should be placed on charges and assessments based on value of services and less on the computed cost of providing services. (Murphy-Rutgers)
W70-01363

**COMMONALITY, THE PRICE SYSTEM, AND USE OF WATER SUPPLIES,**
Florida State Univ; Tallahassee.
Jerome W. Milliman.
The Southern Economic Journal Vol XXII, No 4, p 426-437, April 1956, 12p.

Descriptors: *Economics, *Pricing, *Water resource allocation, *Costs, Water supply, Taxes, Government, Return to scale, Water reuse, Marginal cost, Optimization, Proration, Legal aspects, Water demand.
Identifiers: *Commonality, *Spill-over costs, Quotas, Social costs, Costs of production.

This paper seeks to show that greater reliance should be placed upon the price system to allocate water resources efficiently among the competing uses and users. Water as a resource or factor of production has no unique qualities which should cause it to be treated differently from any other economic resource. The major deterrent to the increased use of the price system to allocate water resources is the fact that water resources are utilized in common, giving rise to the problem of spill-over costs discussed in the article. The two major lines of analysis are: (1) The adjudication of specific water rights through the setting of titles; or (2) The imposition of extraction of use taxes designed to correct the divergence between private and social costs. Each method is discussed and it is stressed that the commonality problem must be dealt with so that the price system can aid in the optimum allocation of water resources. (Murphy-Rutgers)
W70-01364

**COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',**
Montana State Univ., Bozeman.
Oscar R. Burt.
Water Resources Research, Vol 5, No 4, p 905-907, August 1969. 3p, 1 fig, 6 ref.

Descriptors: *Water pollution control, *Water pollution, *Benefits, Demand, Sport fishing, Recreation demand, Social values, Recreation, Costs, Recreation facilities, Prices, Cost-benefit analysis.
Identifiers: *Recreation benefits, *Consumer surplus, Willingness to pay, Marginal social value, Marginal social cost, Gross benefits, Gross social value.

The author comments on an article and note by Joe B. Stevens pertaining to two alternative measures of benefits associated with water pollution control in a sport fishery. The purpose of this note is to present a third measure and to show that the other two measures are of doubtful logical validity. The two measures of benefits attributable to pollution prevention by Stevens he calls (1) increased consumer surplus and (2) increased willingness to pay. The definition of consumer surplus was taken from Marshal and willingness to pay from Marglin. Stevens' analysis is applied to a graph showing two demand curves: D sub o corresponding to low pollution and D sub 1 corresponding to high pollution. In Stevens' note he is only concerned with a procedure for measuring the gross benefits of pollution control. Stevens apparently felt it necessary to infer social value from only D sub 0 and used D sub 1 only to determine quantity taken at a zero price under polluted conditions. The author feels that the discrepancy in benefits associated with pollution control that Stevens found when using the two criteria is a result of his dubious method of applying the two criteria. The author then presents a generalized framework for analysis which permits evaluation of pollution control under the assumption of optimum pricing. Here, the difference in net values associated with polluted and unpolluted water measures the social reward from pollution control when recreation facilities are optimally priced. This net social value could then be compared with the initial investment cost of pollution control in some sort of benefit-cost framework. (Loeb-Rutgers)
W70-01366

**THE INTERNAL RATE OF RETURN AS A RANKING CRITERION,**
Michigan Univ., Ann Arbor; AND Stanford Univ., Calif.
James C. T. Mao.
The Engineering Economist, Vol 11, No 4, p 1-13, Summer 1966. 13p, 2 fig, 8 ref.

Descriptors: *Investment, Decision making.
Identifiers: *Internal rate of return, *Ranking criterion, Net present value, Reinvestment rate, Marginal investment return, Fisherian intersection.

In two recent articles, Teichroew, Robischeck, and Montalbano investigated the net present value (NPV) and the internal rate of return (IRR) criteria for accepting or rejecting investment alternatives available to a firm. The accept-reject decisions are the only investment decisions with which a firm need be concerned provided its capital is not rational and its investments are not mutually exclusive. Realistically, however, firms must frequently choose among mutually exclusive investments and more often than not have only limited access to the capital market. When these conditions prevail, optimal decision procedure requires that each investment be appraised both on its own merit and in relation to the merits of any other competing investments. For such appraisals, the management needs not only a rule for classifying investments into acceptable and unacceptable projects but also a criterion for ranking investments in the order of their profitability. The purpose of this paper is to compare the NPV and the IRR as a criterion for ranking competing investments. This article may provide the water researcher with an analysis to decide between investment alternatives embodying different technologies or different project objectives. (Loeb-Rutgers)
W70-01370

**SOME MANAGERIAL INFLUENCES ON A FIRM'S PRICING POLICY,**
Lancaster Univ., Bailrigg (England).
A. J. Burkart.
Journal of Industrial Economics, Vol 17, No 3, p 180-187, July 1969. 8p.

Descriptors: *Pricing, Demand, Costs, Budgeting.
Identifiers: *Managerial influence, *Pricing policy, Administrative deterrents, New products, Irrationalities.

The author discusses certain factors influencing a firm's pricing policy, which arise more from the way a firm is run than from the way it reacts to changes in the market. The author argues that managerial influences tend to militate against a flexible pricing policy, or a policy that recognizes and seeks opportunities to vary, upwards or downwards, the prices of the firm's products. A firm will determine a price which seems to it appropriate and an estimate of market demand will only be one consideration in this process. The author argues that a firm's prices will be set at a level arrived at in practical terms by successive adjustments from previous historical levels and possibly without much explicit consideration of market demand. Generally, rising costs are a more potent factor in the raising of prices than is buoyant demand. The author then discusses certain managerial influences tending to incline a firm to keep intact its current prices and price structure. This paper, therefore, may provide alternative treatments to the pricing decisions of water supply systems instead of relating water pricing policies to conventional microeconomic demand analysis. (Loeb-Rutgers)
W70-01371

**UNEMPLOYMENT AND COST-BENEFIT ANALYSIS,**
Pennsylvania Univ., Philadelphia; Princeton Univ., N.J.; and Rochester Univ., N.Y.
Nevins D. Baxter, E. P. Howrey, and R. G. Penner.
Public Finance, Vol 24, No 1, p 80-88, 1969.

Descriptors: *Unemployment, *Cost-benefit analysis, Employment, Benefits, Costs, Interest rate, Prices.
Identifiers: *Local employment, Target employment rate, Geographical distribution, Regional employment, Public projects.

The standard works on cost-benefit analysis are somewhat ambivalent on whether the presence of unemployment warrants an adjustment to the usual calculation of benefits and costs. Eckstein points out that the government will usually have a long list of projects which can be justified on the basis of cost-benefit calculations made under the assumption of full employment. He argues that they should simply proceed somewhat further down the list in times of unemployment. However, if there are not a sufficient number of projects which qualify under the full employment assumption, he suggests that the benefit-cost ratios be adjusted upward by using a lower interest rate and by adjusting raw material and factor prices downward. McKean agrees that unemployment warrants some adjustment of benefit-cost estimates, but suggests that practical problems preclude incorporating the effects of unemployment in the calculation. Prest and Turvey adopt McKean's position but argue that some adjustment might be warranted if unemployment exists in the locality of the project. This note argues that there are conceptual as well as practical reasons for not adjusting benefit-cost estimates to reflect national unemployment levels. The calculation of local employment effects is also considered with particular reference to whether these effects should be counted as part of the total benefits. This should prove applicable to the water area since cost-benefit analysis is employed in the decision making process for many water investment projects. (Loeb-Rutgers)
W70-01375

**NUCLEAR DESALTING - FUTURE TRENDS, AND TODAYS COSTS,**
Applied Research and Engineering Ltd., Durham (England).
For primary bibliographic entry see Field 03A.
W70-01535

**THE LARGE PLANT CONCEPT,**
Kellogg M. W. Co., New York.
L. Axelrod, R. E. Daze, and H. P. Wickham.
Chem Engr Progr 64 (7), 17-25, 1968. 9 p, 10 fig.
Identifiers: *Chemical production, *Economic evaluations, *Operating experience, Multipurpose plant, Operational problems, Plant factor, Startups.

Factors affecting the economics and operating problems encountered in installing large plants are reviewed. Comparisons are presented for the investment and manufacturing costs of medium and large size fluid catalytic cracking units, ethylene plants and ammonia plants. In the case of the cracking units and ethylene plants, operating cost savings in the larger plants are almost entirely due to the effect of scale on investment. However, for ammonia plants, larger plants permit the use of centrifugal compressors with turbine drives which permit significant heat recovery within the process. The maximum size of large plants doubles every five years. The startup times and stream factors experienced for 17 large ammonia plants are given. Two-thirds of the plants were making product within 45 days and were at full capacity after 65 days. Problems that have reduced stream factors in cracking plants are reviewed along with the effect of average stream factor over a four-year period of operation on the interest rate of return.
W70-01555

**BRIDGE REVENUE BOND ACT.**

Miss Code Ann secs 8448-8469.5 (1956), secs 8469.5-01 thru 8469.5-09 (Supp 1968).

Descriptors: *Mississippi, *Bridges, *Bridge construction, *Financing, Civil engineering, Capital, Financial feasibility, Government finance, Local governments, State governments, Costs, Construction costs, Condemnation, Legislation, Legal aspects, Construction, Mississippi River.

Any county or city is authorized to acquire by purchase or condemnation and to construct, improve, or operate Mississippi River bridges which are wholly or partly within such county or city or are within twenty miles thereof. Revenue bonds may be issued to finance the cost of such bridges, provided the bond issue is approved by a majority of the electorate. No bridge for the use of the traveling public or ferry may be constructed or operated within fifteen miles of a toll birdge financed by revenue bonds under this act unless permission is given by the state highway commission. A bridge commission may be formed by the governing authorities of a city or county which has acquired or constructed a bridge authorized by this act and has issued revenue bonds to finance the acquisition or construction. The commission shall serve at the pleasure of the governing authority of the political subdivision and shall be empowered to supervise and maintain the bridge as a separate proprietary venture. (Kelly-Florida)
W70-01599

## 6D. Water Demand

**WATER SUPPLIES FOR COULEE DAM NATIONAL RECREATION AREA, WASHINGTON,**
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02E.
W70-01244

**WATER USE IN THE UNITED STATES IN 1965,**
Geological Survey, Washington, D.C.
C. Richard Murray.
J Amer Water Works Ass, Vol 61, No 11, p 567-571, Nov 1969. 5 p, 8 fig, 4 tab, 6 ref.

Descriptors: *Water utilization, *Consumptive use, Industrial water, Municipal water, Domestic water, Irrigation water, Water supply, Data collections, Hydrologic data, Reviews, Surveys.
Identifiers: US Water use (1965).

Data on water consumption in 1965 in the US were compiled by the USGS from readily available sources and a summary article was prepared from that report. Estimates are given of the quantity of water used in the states and water-use regions of the US for public, rural, irrigation, self-supplied industrial, and hydroelectric uses. Consumptive use is also estimated. In 1965, about 310,000 mgd were withdrawn for all uses except hydroelectric power. Of this water, about 78,000 mgd were consumed. About 2,300,000 mgd were withdrawn for hydroelectric power. Industrial withdrawal was about 170,000 mgd, about 125,000 mgd of which was fresh and 45,000 mgd saline. Irrigation withdrawals were about 120,000 mgd, public supplies used 24,000 mgd and rural uses, 4,000 mgd. Groundwater supplied about 20% of all withdrawals. Of 78,000 mgd consumed, irrigation used 66,000 mgd, public supplies 5,200 mgd, and rural, 3,200 mgd. (Knapp-USGS)
W70-01260

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01301

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN**

**CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01302

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01303

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 04A.
W70-01304

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01305

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01306

**COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',**
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 06C.
W70-01366

**AN INDUSTRIAL WASTE GUIDE TO THE COTTON TEXTILE INDUSTRY.**

AATCC, Nat Stream Sanitation Comm and Nat Tech Task Comm on Industrial Wastes, Publ Health Serv pub 677, 1959. 3 p.

Descriptors: *Cotton, *Sludge disposal, *Filtration, *Neutralization, *Remedies, *Aeration, Waste water disposal, Waste water treatment, Activated sludge, Lagoons, Separation techniques, Chemical presepitation.
Identifiers: *Biological oxidation, *Slashing wastes, *Dyeing wastes, *Desizing wastes, *Scouring wastes, *Equilization, *Chemical oxidation, Trickling, Filters, Waste volume reduction, Process modification, Recovery (Wastes), Substitution of chemicals.

This publication is intended primarily to assist the operators and managers of cotton textile processing plants to utilize, reduce and otherwise suitably dispose of their waste waters. Contents: introduction, description of process; sources; characteristics, and pollution effects of process wastes; remedial measures; the solution of specific waste problems; summary and bibliography. (Goodwin-North Carolina State Univ)
W70-01492

**REPORTS ON THE PROGRESS OF APPLIED CHEMISTRY - 1963.**

Soc of Chemical Industry, p 795, Vol XLVIII.

Descriptors: *Detergents, *Biodegradation, *Legislation, *Activated sludge, *Sludge treatment, Industrial wastes, Sewage, Fish, Instrumentation, Toxicity.
Identifiers: ABS, Molecular structure, Non ionic surfactants.

Contents include the following reviews: Dyestuff Intermediate and Fluorescent Brightening Agents, by M. C. Clark and E. Brunner, p. 14-37; Dyestuffs, by C. V. Stead, p. 38-56; Synthetic Fibers (polyolefin fibers), by G. W. Taylor, p 195-202; Synthetic Fibers (acrylic fibers), by V. Furness, p. 202-208; Bleaching, Dyeing and Finishing, by J. T. Marsh, p. 209-220; Sewage, Trade Wastes, and River Pollution, by J. McNicholas, p. 322-333; and Biodegradability of Detergents, by D. W. G. Dicker, p. 334-342.
W70-01506

**NUCLEAR ENERGY CENTERS - INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03E.
W70-01560

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
Fletcher N. Baldwin, Jr.
U Fla L Rev, vol 16, no 3, p 370-423, Winter 1963, 54 p, 242 ref.

Descriptors: *Water resources development, *Governments, *Federal-state water rights conflicts, *Relative rights, Federal government, Multiple-purpose projects, Natural resources, Planning, Political aspects, Legal aspects, State governments, Water conservation, Water resources, Water supply, Water rights, Riparian rights, Jurisdiction, Navigable rivers, Navigable waters, Navigation, Non-navigable waters, Compensation, Federal jurisdiction, Water policy, Obstruction to flow, Prescriptive rights, Water pollution.
Identifiers: *Commerce clause.

The federal resources development program has been made possible largely by the United States Supreme Court's development and interpretation of the commerce clause. The federal government now has complete control over navigable waters and qualified control over non-navigable waters. Federal power or dominant servitude has extinguished riparian rights of individuals and of the states if either limited federal control. Certain riparian interests may be taken without compensation on both navigable and non-navigable waterbodies. Riparian owners do not want to give up state-granted water rights, and state action and cooperation is preferred, but in the absence of state initiative the federal government must act to preserve the nation's critical water supply. The national government can take away riparian rights, and the commerce clause is useful in justifying federal encroachment, but in settling conflicts the Supreme Court continues to be the ultimate water law agency. The riparian rights doctrine must be altered for efficient use of the water supply. It is time for serious federal-state cooperation in working out solutions to water problems facing the nation at both levels of government. (Douberley-Florida)
W70-01593

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
Fletcher N. Baldwin, Jr.
U Fla L Rev, Vol 16, No 3, p 370-388, Winter 1963.

Descriptors: *Navigable waters, *Non-navigable waters, *Federal-state water rights conflicts, *Tributaries, Water resources development, Navigation, Navigable rivers, Judicial decisions, Streams, Riparian waters, Riparian rights, Relative rights, Rivers, Multiple-purpose projects, Flood control, Federal government, Federal jurisdiction, Regulation, Legal aspects.
Identifiers: *Commerce clause, Constitutional law.

The development and interpretation of the commerce clause by the Supreme Court has laid a foundation that allows the federal government to provide for the optimal utilization of the water resources available. Justice Marshall declared that the regulation of commerce was the regulation of commercial navigation, and federal authority was quickly extended to all navigable waters, exclusive of state interference. This authority was broadened to non-navigable tributaries, if water commerce was affected, and to streams with even a potential availability for navigation. Where riparian rights in any way limited federal control, they were extinguished. If shown that a stream could be made navigable by reasonable improvements, that Congress intended some benefit to commerce, or that projects along a non-navigable tributary somehow aided navigation, Congressional exercises of power would be upheld. Flood control and waterway development were added to the maintenance of navigation as legitimate constitutional objectives. (Douberley-Florida)
W70-01594

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
Fletcher N. Baldwin, Jr.
U Fla L Rev, Vol 16, No 3, p 388-403, Winter 1963.

Descriptors: *Navigable waters, *Non-navigable waters, *Compensation, *Damages, Navigable rivers, Federal-state water rights conflicts, Riparian rights, Diversion, Riparian land, Tributaries, Ownership of beds, River beds, Access routes, Banks, High water mark, Bank erosion, Flood damage, Project purposes, Federal government, Legal aspects, Obstruction to flow, Alteration of flow, Regulation, Control.
Identifiers: Dominant servitude, Harbor lines.

The power to regulate and improve navigable waters has created a dominant servitude in favor of the federal government. The government is not held responsible for any damage caused to private riparian property as a direct result of the regulation and improvement of navigable waters. On the other hand, compensation may be awarded to riparians on a non-navigable tributary of the improved navigable waterbody. The navigable servitude doctrine is also extended to non-navigable streams as long as improvements are necessary for the improvement of navigation in the connecting watercourse. The power to establish harbor lines limits the construction of state and private structures to within established areas, but there is no compensation for financial hardship as long as the government does not actually injure or physically take property. The riparian's right to access may also be destroyed without compensation. There is no compensation for injury to riparian embankments caused by alteration of flow by dams, and flood damage may be declared an act of nature. The Court, as the ultimate water law agency, may well eliminate the distinctions between navigable and non-navigable streams. (Douberley-Florida)
W70-01595

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
Fletcher N. Baldwin, Jr.
U Fla L Rev, Vol 16, No 3, p 403-423, Winter 1963.

Descriptors: *Water resources development, *Federal-state water rights conflicts, *Project planning, *Water utilization, Political aspects, Relative rights, Riparian rights, Navigable waters, Non-navigable waters, State governments, Federal government, Water management (Applied), Water conservation, Planning, Social function, Water rights, Cooperatives, Judicial decisions.

Identifiers: *Federal-state cooperation.

The expanding interpretation of the commerce clause must conform to the needs of national water problems, whether it was intended to be extended to non-navigable streams or not. States may have the best access and control of water, but the federal government also has a concern in remedying the critical water resources problem. Lack of aggressive state action continues to force the federal government to plan for and counter these problems, and so long as federal activity presents some aspect of proper federal control the courts will not restrict it. Water rights of the states as well as of the individual are limited by federal supremacy, but state activity has been allowed where Congress has elected not to intrude. States are also given a voice in federal-state cooperative projects, but this cooperation has been severely inadequate. Where federal-state conflicts cannot be resolved, the Supreme Court will support the federal government, but the court should not be the ultimate water law agency. Serious cooperation is needed in working out a more efficient system of water use and management and especially in altering the riparian rights doctrine. (Douberley-Florida)
W70-01596

**WATER AND WATER COURSES - LAND-LOCKED NON-NAVIGABLE LAKES - OWNERS RESTRICTED TO REASONABLE USE.**

Rutgers L Rev, vol 14, no 4, p 837-840, Summer 1960, 4 p, 27 ref.

Descriptors: *Florida, *Non-navigable waters, *Relative rights, *Reasonable use, Civil law, Water policy, Right-of-way, Access routes, Lakes, Competing uses, Domestic water, Natural use, Obstruction to flow, Recreation, Riparian rights, Boundaries (Property), Lake beds, Lake shores, Ownership of beds, Judicial decisions.
Identifiers: Common law.

Defendants were owners of riparian land adjacent to plaintiff's riparian lands. Said properties extended to and underlay a corner of a land-locked, non-navigable lake. Defendants erected water barriers along the boundaries of their submerged lands, thereby eliminating plaintiff's use of that portion of the lake overlying defendant's fee. The Florida court ordered that the enclosures be removed. In so ruling, the court adopted the civil law rule, which holds that each riparian owner has a right of access to the entire lake instead of the common law rule, which states that each riparian owner has absolute control of the water which overlies his fee. This preference for the civil law rule was based on grounds of public policy in a water-oriented resort state. However, the court failed to discuss the inequity of allowing each owner full use of the lake despite possible discrepancies in the comparative size of the various holdings. While the theory of reasonable use, as part of the civil law rule, is appropriate for running waters, it is suggested that a better test would involve the reasonable man in a similar position; this would take into account defendant's motives. (Smith-Florida)
W70-01627

## 6E. Water Law and Institutions

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967. 66 p, 133 ref.

Descriptors: *New York, *Alteration of flow, *Reasonable use, *Preferences (Water rights), Legislation, Planning, Water resources development, Riparian land, Riparian water, Riparian rights, Water rights, Natural flow doctrine, Competing uses, Domestic water, Natural use, Obstructions to flow, Relative rights, Bodies of water, Water users, Water utilization, Water allocation (Policy), Water policy, Water pollution, Legal aspects.
Identifiers: Trespass, Negligence.

A number of additions to the New York conservation law are proposed by the Cornell Water Resources Center. It is proposed that a riparian owner should have no cause of action for damages against a co-riparian who alters the natural flow, quality, quantity, or condition of a body of water to further the use and enjoyment of riparian property, so long as the alteration is reasonable. The same privilege to make alterations should be extended to include an alternative of furthering the use of non-riparian land. The factors that should be considered in determining the reasonableness of harm are outlined. The proposals are not to affect actions for negligence or trespass and do not affect pollution laws or injunctions by governmental bodies. Each proposed section is accompanied by comments on the desirability of the legislation, its need in the state, and its constitutionality in the face of anticipated attacks. (Douberley-Florida)
W70-01301

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 5-6, p 13-17, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Alteration of flow, *Reasonable use, *Riparian rights, *Preferences (Water rights), Lakes, Streams, Water resources development, Natural flow doctrine, Relative rights, Streamflow, Water quality, Riparian land, Riparian waters, Water rights, Competing uses, Prior appropriation, Priorities, Artificial use, Obstructions to flow, Bodies of water, Water utilization, Legal aspects.

The Cornell Water Resources Center proposes a number of additions to the New York conservation law for the purpose of reducing uncertainties in the state common law concerning rights of riparians on streams and lakes. Such additions would enable private parties to undertake water-connected projects while being sure of their rights, and draftsmen of water resources development statutes may better determine legal obstacles with reasonable certainty. Section 429-k of the proposal provides that an alteration in the natural flow, quantity, quality, or condition of a body of water by a riparian owner to further the use and enjoyment of riparian property may not give rise to a cause of action if the alteration is reasonable, even though it is causing real or substantial harm to others. The establishment of reasonableness in a particular circumstance is preferable to definite rules that cannot cover the infinite number of conceivable situations. The rule that makes an alteration harmful if it harms a co-riparian gives a permanent advantage to the riparian who first exercises his riparian rights, in violation of established principles of the riparian doctrine, and imposes a rigidity that makes it difficult to meet new water needs. (Douberley-Florida)
W70-01302

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 17-32, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Water rights, *Public benefits, *Riparian rights, *Preferences (Water rights), Water pollution, Cities, Compensation, Benefits, Comparative benefits, Relative rights, Projects, Project planning, Regulation, Legal aspects.
Identifiers: Harmful use, Water rights impairment, Constitutional law.

Proposed section 429-k does not affect enforcement of pollution statutes, and it is needed to counter uncertainty created by dicta that might allow an opposite interpretation of existing law. Constitutional challenges that the rights of those harmed are deprived without just compensation are not plausible because the proposal is a valid exercise of the police power in furtherance of the public interest, and the impairment of rights is so small as not to constitute a taking. The public interest greatly outweighs the incidental harm to rights of riparians. The state is not depriving riparians of rights but is merely readjusting rights among co-riparians. Although recent decisions may present some problems with overly broad language condemning similar provisions, no court has struck down a statute that destroys a cause of action only for injury suffered as the result of a reasonable activity. (Douberley-Florida)
W70-01303

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 04A.
W70-01304

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 9-11, p 38-57, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Reasonable use, *Public benefits, *Relative rights, *Preferences (Water rights), Alteration of flow, Natural streams, Lakes, Regions, Access routes, Priorities, Regulation, Riparian land, Riparian waters, Riparian rights, Diversion, Obstruction to flow, Water resources development.
Identifiers: Malicious acts.

Section 429-m lists the factors that should be considered in determining the reasonableness of harmful alterations in watercourses and lakes. These considerations should include: (1) suitability to the region, in view of custom; (2) relative importance to the public; (3) amount of harm caused, although a finding of greater harm than an alternative is not determinative; (4) ease of minimizing or avoiding harm; (5) location of the contestants' points of access; (6) priority in time of the commencement of activities, although priority does not necessarily establish reasonableness; and (7) motive of the person effecting alterations, although only a primarily malicious motive is determinative. No alteration should be classified as unreasonable as a matter of

law because of its nature or consequences. This section codifies the principle of variability in response to changing conditions, which is valuable in meeting changing water needs. The public interest in developing water resources outweighs the right of riparians to be free from reasonable harm. The provision should be made retroactive. Constitutional challenges may be met as a permissible exercise of the police power, since only small expenditures by the challenger would probably be involved. (Douberley-Florida)
W70-01305

**STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.**
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 11-12, p 58-66, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Alteration of flow, *Riparian rights, *Municipal water, *Water utilization, Natural flow doctrine, Riparian land, Riparian water, Reasonable use, Public benefits, Domestic water, Cities, Compensation, Artificial use, Flooding (Intentional inundation), Flood damage, Bodies of water, Beds under water, Legal aspects, Surface waters.
Identifiers: Negligence, Trespass.

According to section 429-n, nothing in the proposed provisions will affect common law actions against a person who effects an alteration in a negligent manner. The determinative factors for negligence are similar to those used in determining reasonableness, including whether the risk of harm is unreasonable in view of the social value, whether less dangerous methods could be used, or whether the conduct is customary. The riparian's right to freedom from personal intrusion and the common law rule that domestic uses are reasonable as a matter of law remain intact. Municipal rights are not altered, and it is doubtful that existing law allows a municipality to take water without compensating riparians. Section 429-o does not increase the instances where a person may enter riparian land, above or below the surface or may cause harm by flooding another's dry land. The common law domestic use doctrine is not altered. (Douberley-Florida)
W70-01306

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01307

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01308

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01309

**BEACHES.**

Miss Code Ann sec 2018.7 (Supp 1968).

Descriptors: *Mississippi, *Beaches, *Recreation, *Recreation facilities, Shores, Sands, Lakes, Public health, Safety, Lake shores, Seashores, Coasts, Inland waterways, Legislation, Recreation wastes, Disposal, Waste disposal.

For the purpose of this act, 'established beach' shall include any sand beach, natural or man-made, along any natural coastline or inland lake, designated or used for public recreational purposes. (Schram-Florida)
W70-01310

**USE OF LICENSE FEES; FISH RESTORATION PROJECTS.**
Va Code Ann sec 29-1.1 (1969).

Descriptors: *Virginia, *Administrative agencies, *Fish management, *Fish reproduction, Fisheries, Federal government, State governments, Fish conservation, Permits, Fish stocking, Political aspects, Regulation, Administration, Conservation, Coordination, Legislation, Financing.

License fees of fishermen are used for the administration of the Division of Fish and Game and for fish preservation. Fish restoration projects that comply with regulations of the Secretary of the Interior may not conflict with state laws. (McDonough-Florida)
W70-01311

**SAMPLING FOR WATER POLLUTION.**
For primary bibliographic entry see Field 05G.
W70-01312

**LICENSE TAXES AND REQUIREMENTS TO TAKE SHELLFISH.**
Va Code Ann secs 28.1-119 thru 28.1-123 (1969).

Descriptors: *Virginia, *Permits, *Taxes, *Commercial shellfish, Tax rate, Oysters, Clams, Shellfish, Commercial fishing, Administrative agencies, Fisheries, Conservation, Fish conservations, Legislation.
Identifiers: Residency requirements.

The state graduated license tax on persons, firms, and corporations engaged in the business of shucking or packing oysters is based on the volume of business during the license period. The tax is computed on written volume reports filed by the licensee in January of each year. False reporting constitutes a misdemeanor. This license tax is in lieu of all state taxes on the capital of the business. Persons wishing to take or catch oysters or clams by hand or tongs from areas not leased for oyster planting purposes must be licensed and have the license available for inspection. Licensing requirements do not attach to persons taking clams or oysters for immediate household use. Non-residents are those persons not paying state taxes, not residing in the state over a year, or landowners not residing in the state over four months. Non-residents taking or planting oysters for market or profit are guilty of a misdemeanor. It is a misdemeanor for citizens of this state to be interested with any non-resident in the commercial taking of fish or shellfish or oyster planting in state waters. (McDonough-Florida)
W70-01313

**CRABS.**

Va Code Ann secs 28.1-165 thru 28.1-174 (1969).

Descriptors: *Virginia, *Commercial fishing, *Commercial shellfish, *Crabs, Taxes, Permits, Inspection, Control, Regulation, Administrative agencies, Dredging, Legislation, Legal aspects, State jurisdiction, Fish conservation, Supervisory control (Power), Fisheries.

Persons desiring to take crabs for market or profit from the waters of the state and persons engaging in the business of buying or marketing crabs must pay an annual license tax. The amount of the tax varies according to the method and scale of the crab fishing. Use of scrapes and dredges for catching crabs is prohibited during a specified season. The Commission of Fisheries may modify the prohibition in certain circumstances. Crabs must surpass certain size limitations before they may be retained when caught. The inspector for each district may examine any catches to determine whether the crabs therein meet statutory size requirements. The number of crabs that can be taken by one boat in one day may be limited at the Commissioner's discretion. Sponge crabs may not be taken from May to September within a certain geographical area. Crabs generally may not be taken commercially on Sunday or at night. Crab traps or pounds must be placed at least one hundred yards apart and must be completely removed from the water at the end of each season. Anyone may take up to one bushel of crabs per day for household use without obtaining a license. (Kelly-Florida)
W70-01314

**HEALTH PROVISIONS: FISH AND SHELLFISH.**
Va Code Ann secs 28.1-175 thru 28.1-183.1 (1969).

Descriptors: *Virginia, *Commercial fishing, *Commercial shellfish, *Public health, Fish conservation, Water pollution, Fish management, Environmental sanitation, Environmental effects, Regulation, Administrative agencies, Control, Inspection, Permits, Shellfish, Legislation, Legal aspects, Supervisory control (Power).

The State Health Commissioner is authorized to examine fish and shellfish in planting grounds and in packing houses within the state or in other places from which the fish and shellfish are to be taken or sold for food purposes. He may survey the sanitary conditions and pollution hazards adjacent to and within shellfish growing areas and within packing houses and plants for the purposes of protecting the industries and the public health and preventing the sale of fish and shellfish deemed unfit for market. The Health Commissioner shall notify the Commissioner of Fisheries of any findings of unfit fish or shellfish and of unsanitary or polluted conditions. He shall also notify any affected owner of fishing grounds or plant operator and may enjoin further operation and/or fishing until corrections are made. Polluted fish or shellfish grounds may be condemned seasonally or indefinitely by the State Health Commissioner. Areas may be closed in emergencies without recourse to hearings. Some replanting may be permitted of shellfish from condemned areas under close Commission supervision. All oysters and clams imported from other states must have been certified fit for market. The Fisheries or Health Commissioners may seize goods caught and/or sold contrary to this statute. (Kelly-Florida)
W70-01315

**ENFORCEMENT OF FISH AND SHELLFISH REGULATIONS.**
Va Cpde Amm secs 28.1-184 thru 28.1-194 (1969).

Descriptors: *Virginia, *Commercial fishing, *Regulation, *Commercial shellfish, Maryland, Bays, Tidal waters, Fish conservation, Fish management, Shellfish, Legislation, Legal aspects, Inspection, Investigations, Permits, Control, Administrative agencies, Supervisory control (Power), Political aspects, Water policy.
Identifiers: Chesapeake Bay, Interstate cooperation.

The Commission and Commissioner of Fisheries, all inspectors, police captains of boats, and other authorized agents may arrest any violator of the state's fish or shellfish laws with or without a warrant. They may, further, seize any vessel and/or cargo pursuant to enforcement of these laws. Violations of the fish or shellfish laws constitute misdemeanors. Maryland authorities attempting to make arrests or seizures for violation of Maryland fish and shellfish laws may cross the Virginia-Maryland boundary in the Chesapeake Bay to make such arrests. No person may use any drag box, tub, or sack for taking fish or shellfish in the state; possession of such a device carries a presumption of guilt. Licenses and names of boats registered for purposes of this chapter must be kept in plain view. No inspector or other officer apprehending any person

for any violation of fish or shellfish laws is authorized to settle with such offender or release him from any resulting legal proceedings. (Kelly-Florida)
W70-01316

**VIRGINIA INSTITUTE OF MARINE SCIENCE.**

Va Code Ann secs 28.1-195 thru 28.1-200 (1969).

Descriptors: *Virginia, *Investigations, *Research facilities, *Water resources development, Fish conservation, Commercial fishing, Recreation, Administrative agencies, Foundation investigations, Data collections, Exploration, Planning, Feasibility, Surveys, Legislation, Legal aspects, Atlantic Ocean, Tidal waters, State jurisdiction, Fisheries, Marine fisheries.
Identifiers: Marine pollution.

The Virginia Institute of Marine Sciences shall be continued as an independent research and service agency. The duties of the Institute include conducting investigations of areas used by seafood and sport-fishing industries, advising the Commission of Fisheries regarding conservation of fisheries' resources, studying marine pollution, making hydrographic and biological studies of the tidal waters of the state and contiguous waters of the Atlantic Ocean, and making other studies as requested by the governor. The Institute may enlist the aid of public or private agencies in conducting its studies and research. It may take any marine organism from the waters of the state, with approval of the Commission of Fisheries, for purposes of carrying out its assigned tasks. (Kelly-Florida)
W70-01317

**ATLANTIC STATES MARINE FISHERIES COMPACT.**

Va Code Ann sec 28.1-202 (1969).

Descriptors: *Virginia, *Interstate compacts, *Fish conservation, *Interstate commissions, Water resources development, Fish management, Atlantic Ocean, Fisheries, Fish stocking, Commercial fishing, Administrative agencies, Wildlife conservation, Legislation, Legal aspects, Regulation, State jurisdiction.

The purpose of the Atlantic States Marine Fisheries Compact is to develop a program for promotion and protection of Atlantic seaboard fisheries and to prevent physical waste of the fisheries from any cause. The Atlantic States Marine Fisheries Commission is hereby created and is composed of representatives from each state adopting the Compact. The Commission is responsible for discovering methods which prevent depletion and waste of fisheries and is empowered to recommend specific coordination of the police powers of the member states. The Commission may draft recommended legislation, advise pertinent administrative agencies, and plan use of jointly stocked waters. The Fish and Wildlife Service of the United States Department of the Interior serves as the primary research agency of the Commission. Nothing in the Compact shall prevent a member state from enacting additional conservation laws, nor shall any provision be construed to repeal a state law. States consenting to an amendment set forth in the Compact may agree to have the Commission serve as a joint regulatory agency for specific fisheries in which such states have a joint interest. (Kelly-Florida)
W70-01318

**WATERS OF THE STATE: REGULATION OF INDUSTRIAL ESTABLISHMENTS.**
For primary bibliographic entry see Field 05G.
W70-01319

**PERMISSION TO CAPTURE FLOODWATERS.**
Va Code Ann secs 62.1-107 thru 62.1-115 (1968).

Descriptors: *Virginia, *Riparian rights, *Water storage, *Floodwater, Permits, Average flow, Water permits, Water levels, Riparian land, Ownership of beds, Diversion structures, Watershed management, Administration, Water rights, Legislation, Projects.

Riparian owners wishing to capture floodwaters must apply to the circuit court in the county where the waters will be stored. The Commissioner of Water Resources then prepares a report showing the average flow at the point where the water will be taken, any conflicts with proposed projects in the watershed, and the effects of the proposed capture on pollution abatement. The court bases its decision on the petition and the report. The state consents to the use of watercourse beds to which it has title for the construction of impounding facilities. Riparian owners storing floodwaters have unrestricted use thereof. (McDonough-Florida)
W70-01320

**VIRGINIA PORTS AUTHORITY.**
Va Code Ann secs 62.1-128, 62.1-132 thru 62.1-134, 62.1-136, 62.1-137 (1968).

Descriptors: *Virginia, *Port authorities, *Harbors, *Navigation, Legislation, Eminent domain, Condemnation, Cities, Maintenance, Administrative agencies, Operations, Operation and maintenance, Construction, Publications, Project purposes, Coordination, Water policy, Income, Leases, Rent, Administration, Docks.
Identifiers: *Commerce.

The Division of Ports of the Department of Conservation and Development is abolished. The Virginia State Ports Authority is created. To unify and promote the development of the port facilities within the municipalities of the state, the governing body of any such city shall have the power to appoint boards of municipal port commissioners. These boards may be delegated any or all of the authority with regard to the ownership, operation, and management of the port terminal facilities within such municipalities. The Board of Commissioners of the Virginia Ports Authority may engage in promoting, developing, constructing, maintaining, and operating the harbors and seaports within the state. The Authority's general purposes include: (1) development of harbors and seaports for the handling of water-borne commerce; (2) improvement of such port facilities and issuance of revenue bonds for this purpose; (3) stimulation of the use of such harbors; (4) issuance of a publication of all port charges, rules, and practices; and (5) performance of any act to increase commerce through such harbors and seaports. The Authority is vested with the power of eminent domain. The Authority may lease such port facilities to the respective city, county, or town. (Schram-Florida)
W70-01321

**VIRGINIA BEACH EROSION COMMISSION.**

Va Code Sec 62.1-154 (1968).

Descriptors: *Virginia, *Erosion, *Beach erosion, *Erosion control, Legislation, Check structures, Conservation, Jetties, Sea walls, Shore protection, Sands, Beaches, Construction, Maintenance, Right-of-way, Shores, Coastal engineering, Tidal effects, Local governments, Administrative agencies, Cities, Regulation.

The Virginia Beach Erosion Commission shall have all of the powers necessary and convenient to carry out the purposes for which it is created. The general purpose of the Commission is to stop or correct erosion along the Atlantic coast in the city of Virginia Beach. The Commission shall have the power: (1) to construct and maintain jetties, groins, and seawalls; (2) to place sand upon the beach for the purpose of controlling erosion; (3) to acquire land, rights-of-way, sand or any kind of material to attain the objects of the Commission; (4) to improve, beautify, maintain, and preserve the ocean front; and (5) to make rules and regulations not inconsistent with law to carry out the general purposes of the Commission. The council of the city may appropriate such funds as it deems necessary to carry out the purposes of the Commission. The Commission also may: (1) sue and be sued; (2) contract with any person, firm, or corporation; (3) make and execute necessary instruments; and (4) accept and expend any gift, grant, or donation from any public or private source. (Schram-Florida)
W70-01322

**SALE OF CORPORATE PROPERTY AND GRANTING OF FRANCHISES BY CITIES AND TOWNS.**
Va Const Art VIII, sec 125, 1968.

Descriptors: *Virginia, *Cities, *Leases, *Public lands, Legislation, Legal aspects, Permits, Easements, Public utilities, Docks, Bridges, Railroads, Public rights, Compensation, Competitive prices, Local governments, Grants, Bids, Contracts.
Identifiers: Wharves.

No city or town may sell its rights in and to its water front, wharf property, public landings, wharves, docks, and bridges except by an ordinance or resolution passed by a recorded affirmative vote of three-fourths of all the members elected to the council. No franchise, lease, or right of any kind to use any such public property or easement of any description, in a manner not permitted to the general public, shall be granted for a period longer than thirty years. Before granting any such franchise, the municipality must first, after due advertisement, receive bids therefor publicly. Such grant may provide that, upon termination of the grant, the plant as well as the property thereupon becomes the property of the municipality. The above may be without compensation or upon the payment of fair value, but the grantee is entitled to no payment by reason of the value of the franchise. Such municipality may then sell or lease any acquired plant or property or control and operate the same. (Schram-Florida)
W70-01323

**NATURAL OYSTER BEDS.**

Va Const art XIII, sec 175, 1968.

Descriptors: *Virginia, *Oysters, *Shoals, *Ownership of beds, Legislation, Beds, Rocks, Leases, Public benefits, Public lands, Public rights, Legal aspects, Regulation, Surveys, Water rights, Withdrawn lands.
Identifiers: *Oyster beds.

The natural oyster beds, rocks, and shoals in the waters of this state shall not be leased, rented, or sold. They shall be held in trust for the benefit of the people of the state and subject to such regulations and restrictions as the General Assembly may prescribe. The General Assembly may, from time to time, define and determine such natural beds, rocks, or shoals by surveys or otherwise. (Schram-Florida)
W70-01324

**CONSERVATION OF OPEN SPACES.**

R I Gen Laws Ann sec 45-36-1, 45-36-2 (Supp 1968).

Descriptors: *Rhode Island, *Conservation, *Natural resources, Legal aspects, Beaches, Tidal waters, Marshes, Wetlands, Soil conservation, Fish conservation, Water conservation, Adoption of practices, Land management, Condemnation, Parks, Preservation, Scenery, Legislation.
Identifiers: Open spaces.

Open space means any space or area the preservation of which would: maintain or enhance the conservation of natural or scenic resources; protect natural streams or water supply; promote conservation of soils, wetlands, beaches, or tidal marshes; or

enhance the value to the public of abutting or neighboring parks, forests, wildlife preserves, or nature reservations or sanctuaries. Any city may acquire land or interests in land and may enter into agreements for the purpose of maintaining, improving, and protecting future use of open spaces, or otherwise conserving open spaces. (Kelly-Florida)
W70-01325

**STATE PARTICIPATION IN FEDERAL NAVIGATION AND FLOOD CONTROL PROJECTS.**
For primary bibliographic entry see Field 04A.
W70-01326

**CONTROL OF BEACH EROSION.**

R I Gen Laws Ann secs 46-3-7 thru 46-3-10 (1956).

Descriptors: *Rhode Island, *Beach erosion, *Erosion control, *Shore protection, Legislation, Landfills, Erosion, Beaches, Dunes, Breakwaters, Bulkheads, Jetties, Riprap, Retaining walls, Land subsidence, Condemnation, Administrative agencies.

The legislative body of a city or town may designate beach areas requiring protective works such as breakwaters, bulkheads, jetties, and other structures to prevent erosion of exposed beaches. The legislative body must apply for state aid in acquiring lands and interests needed for the project and may cooperate with the Division of Harbors and Rivers to plan and finance the appropriate protective works. The Division of Harbors and Rivers may obtain needed properties by condemnation if other methods of acquisition are impossible. (McDonough-Florida)
W70-01327

**PROHIBITION OF WATER POLLUTION.**
For primary bibliographic entry see Field 05G.
W70-01328

**ADOPTION OF APPROVED POLLUTION PREVENTION SYSTEMS.**
For primary bibliographic entry see Field 05G.
W70-01329

**DISCHARGE OF SEWAGE.**
For primary bibliographic entry see Field 05G.
W70-01330

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01331

**DRAINAGE--CONDEMNATION FOR DRAINAGE SYSTEMS.**
For primary bibliographic entry see Field 04A.
W70-01332

**SUBDIVISION ORDINANCES FOR DRAINAGE AND FLOOD CONTROL.**
For primary bibliographic entry see Field 04A.
W70-01333

**PARKS AND RECREATIONAL AREAS.**
RI Gen Laws Ann sec 32-1-3 (1968).

Descriptors: *Rhode Island, *Recreation facilities, *Riparian rights, *Water resources development, Beaches, Facilities, Recreation, Flow, Natural flow, Dams, Dam construction, Condemnation, Eminent domain, Land development, Land management, Administration, Administrative agencies, Boating, Water sports, Fishing, Resource development, Natural resources, Legislation, Parks, Water rights, Conservation.

The Department of Natural Resources may acquire by gift, purchase, condemnation, or devise lands, easements, rights and interests in land for parks, recreation grounds, or bathing beaches in any part of the state, provided that all such property, other than tide-flowed lands acquired by condemnation, shall remain subject to all rights of riparian proprietors on any waters bordering upon such property. All such riparian proprietors have the right to: continue to maintain, repair, or reconstruct dams and appurtenances now existing on such waters; enter upon such property restoring it to its previous condition; and enjoy the same rights of flowage heretofore enjoyed. Subject to these provisions, the Department may permit the use of property acquired under this section and the waters bordering thereon for bathing, boating, fishing, and skating. The Department has the same authority over such lands as it has over other property acquired by law. (Smith-Florida)
W70-01334

**REGISTRATION AND REPORTS OF COMMERCIAL FISHERIES.**
RI Gen Laws Ann secs 20-7-1 thru 20-7-6 (1968).

Descriptors: *Rhode Island, *Permits, *Boats, *Commercial fishing, Commercial fish, Commercial shellfish, Administrative agencies, Bait traps, Nets, Fishing gear, Legislation, State jurisdiction, Buoys, Fish management, Fish conservation.
Identifiers: Penalties (Criminal).

Owners of commercial fishing boats and devices operating out of this state must register with the Department of Natural Resources. Owners must file monthly reports on the number of pounds of fish caught. Fishing traps and buoys must be tagged with the owner's name and registration number. Violations of this chapter are punishable by fine or suspension of registration. (McDonough-Florida)
W70-01335

**ATLANTIC STATES MARINE FISHERIES COMPACT.**

RI Gen Laws Ann secs 20-8-1 thru 20-8-12 (1968).

Descriptors: *Rhode Island, *Interstate compacts, *Interstate commissions, *Fisheries, State governments, Federal government, Fish management, Fish stocking, Conservation, Administrative agencies, Water law, Legislation, Political aspects, Maine, New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Commercial fishing, Financing.
Identifiers: Atlantic states fisheries.

The purpose of the Atlantic States Fisheries Compact is to protect fisheries and prevent their physical waste. The Atlantic States Marine Fisheries Commission, composed of three representatives from each member state, recommends conservation practices and methods to avoid fisheries' waste. The Commission may act as a joint regulatory agency for fisheries of the states. It may recommend legislation to the party states and is available to consult with state agencies. The Commission is supported by annual appropriations of member states and may use the United States Fish and Wildlife Service as its primary research agency. (McDonough-Florida)
W70-01336

**LICENSING AND REGULATION OF FREE AND COMMON SHELLFISHERIES.**

RI Gen Laws Ann secs 20-9-1, 20-9-2, 20-9-6, 20-9-10, 20-9-12, 20-9-13 (1968).

Descriptors: *Rhode Island, *Commercial shellfish, *Shellfish, *Commercial fishing, Permits, Fishing gear, Farm ponds, Fish, Fisheries, Trawling, Administrative agencies, Legislation, State governments, Legal aspects, Boats, Regulation, Fish stocking, Fish farming, Fish reproduction, Aquiculture, Fish conservation, Clams, Oysters, Mussels, Water conservation, Dredging.
Identifiers: *Scallops, Quahaugs.

In order to take oysters, clams, or quahaugs from the free and common fisheries in Rhode Island waters, persons must obtain a license from the Director of Natural Resources. The Director also issues boat registrations for the taking of oysters, clams, and quahaugs and makes and enforces regulations governing registrations and licenses. No person, however, may take oysters from the free and common oyster fisheries between the dates specified. State residents may without a license take as much as one-half bushel of oysters in any one day. The use of dredges for the taking of oysters, clams, quahaugs, scallops, and mussels is herein regulated. Dredging for sea clams or skimmers is permitted in specified areas. This Act establishes number and size limits for shellfish which may be taken. The Director of Natural Resources, in order to preserve and insure the future growth of oysters in Charlestown pond and Green Hill pond, is responsible for transplanting seed oysters to more favorable locations. (Marsee-Florida)
W70-01337

**OYSTER GROUND LEASES.**

RI Gen Laws Ann secs 20-10-1 thru 20-10-3, 20-10-5, 20-10-7, 20-10-9, 20-10-12, 20-10-19, 20-10-22 (1968).

Descriptors: *Rhode Island, *Leases, *Oysters, *Commercial shellfish, Land tenure, Regulation, Legal aspects, Administrative agencies, Legislation, State governments, Jurisdiction, Shellfish, Aquiculture, Commercial fish, Mollusks, Tidal waters, Land development, Wetlands, Mud flats, Contracts, Rent, Beds, Beds under water, Administration, Supervisory control (Power), Surveys.
Identifiers: *Oyster grounds, Shellfish cultivation.

The Director of Natural Resources may lease oyster grounds, within the limitations and terms herein set forth, for the purpose of oyster culture and business. Lease terms vary depending upon the depth of tidewater covering such grounds at mean low tide. In general, lands must be covered by at least four feet of water. Exceptions are made for specified areas. Deep water leases, where the depth of such waters is at least at twelve feet, are allowed in Naragansett Bay and tributaries. Leases may be renewed. The Director may lease soft or mud bottom lands for the purpose of having such lands made suitable for oyster and shellfish planting and cultivation. It is unlawful for persons to wrongfully make claim upon public oyster grounds, and penalties are provided. Specified grounds are not subject to lease, and special rules exist for given ponds. Before leasing lands, the Director has the lands surveyed, platted, and properly marked with stakes or buoys. The Director supervises the care and removal of such stakes and buoys. Oysters planted or growing in privately leased oyster grounds are the lessee's property. (Marsee-Florida)
W70-01338

**ERADICATION OF STAR FISH.**

RI Gen Laws Ann secs 20-20-1 thru 20-20-7 (1968).

Descriptors: *Rhode Island, *Fish management, *Pest control, *Water resources development, Animal control, Control, Fishing, Fishkill, Fish, Fish harvest, Wildlife conservation, Spawning, Fish reproduction, Permits, Weight, Dredging, Administration, Adminstrative agencies, Regulation, Government finance, Costs, Financing, Legislation, Supervisory control (Power), Fish conservation.
Identifiers: Star fish eradication.

The general assembly annually appropriates money for the eradication of star fish in the waters of

Rhode Island and for a suitable bounty for such star fish. The controller may draw on the general treasury for such sums approved by the Director of Natural Resources for such purposes. The Director designates fishing zones for star fish, strategically located so as to break up star fish spawning beds. The Department of Natural Resources issues permits for each boat used to dredge for star fish. The bounty must be set between seventy-five cents and one dollar per hundred pounds of star fish, and the Department must designate the locations of three weighing stations to be used in weighing each licensee's catch. No bounty is paid for star fish taken from leased grounds or for star fish dredged by oyster companies. Such fishing is legal only between sunrise and sunset, Tuesday through Sunday, and only approved trawls and dredges are permitted. The Director makes rules and regulations necessary to carry out the provisions of this chapter. (Smith-Florida)
W70-01339

**BLASTING REGULATIONS.**

Pa Stat Ann Tit 73, sec 166 (Supp 1969).

Descriptors: *Pennsylvania, *explosives, *Standards, *Administration, Control, Governments, Explosions, Highways, Streams, Rivers, Regulation, Administrative agencies, Channels, Permits.

The use of explosives for blasting in the neighborhood of any public highway, stream of water, dwelling house, or pipe line shall be done in accordance with the provisions of this section and rules and regulations promulgated by the Department of Labor and Industry. Standards for blasting and standards for instruments for determining the particle velocity of blasts are established. Blasting near streams is prohibited in all cases where the effect of the blasting is liable to change the course or channel of any stream, unless a permit is first obtained from the Department. (Smith-Florida)
W70-01340

**THE ROLE OF THE PUBLIC DISTRICT IN THE INTEGRATED MANAGEMENT OF GROUND AND SURFACE WATER,**
Colorado State Univ., Fort Collins.
Stephen C. Smith.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 341-352, 1964. ref.

Descriptors: *Water districts, *Groundwater, *Surface water, *Water rights, *Water conservation, *Economics, *Regional planning, River basin, Compaction, Reservoirs, Overdraft, Wells, Floods, Recreation, Dams, Percolation, Irrigation, Compensation, Recharge, Discharge.
Identifiers: *Public districts, *Nonappropriation states, *Cyclic fluctuations, *Interregional transport, Storm-water drainage.

In this article, the public district is discussed as a public agency which is used in organizing integrated management of ground and surface water. Through the organizational process, integration can be achieved among both internal and external interests if the district has the legal, political and economic responsibility to perform this function. The public district is therefore an agency for collective action. This agency can function both where there is no state statutory administration of water rights and in appropriative states, especially in enacting programs such as combating physical uncertainties due to cyclic fluctuations, salt-water intrusion or compaction. Some management practices of the district may affect the legal status of water rights. The district can act to settle conflicts of interest internally by integrating the management of ground and surface water. The district can serve to relate repayment of a current investment in water utilization facilities to economic benefits accruing to the area over time. Finally, the district can represent internal interests within the district on a common basis to external interests in water management. (Murphy-Rutgers)
W70-01343

**ORGANIZATIONS AND WATER RIGHTS IN THE RURAL-URBAN TRANSFER OF WATER,**
Colorado State Univ., Fort Collins.
Stephen C. Smith.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 353-367, 1964. 15 p, 40 ref.

Descriptors: *Water allocation, *Economics, *Water rights, *Prior appropriation, *Riparian rights, Water resource development, Water policy, Cost-benefit analysis, Decision making, Water districts, Government, Cities, Surface water, Irrigation, Economic efficiency, Wells, Groundwater.
Identifiers: *Rural/urban competition, *Institutional machinery, *Correlative rights, *Beneficial use.

This article deals with the role of institutions in water economics, a delineation of institutional machinery, a definition of water rights as related to economic change, and economic competition within and between organizations. The economics in water policy is chiefly concerned with the problem of allocating water between rural and urban uses. Since this problem involves water rights, it is closely bound to public policy in which laws and institutions are used to represent values in the decision-making process. The institutions involved in water transfer encompass public districts, municipalities, state government and federal government. These are all concerned with the water problems of appropriative rights, riparian rights, correlative rights, and beneficial use. In the rural-urban transfer of water use, the economics involved call for study of water rights as real property, urban expansion, and inter-agency/intra-agency conflicts. Large interregional transfer agencies have become the predominant organizations in dealing with these difficulties, and the internal policies of such organizations have become more important in the problems than they were before, reflecting the dynamic character of the economy. (Murphy-Rutgers)
W70-01348

**THE ABATEMENT OF POLLUTION.**
Council of Economic Advisors, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-01349

**WATER RESOURCES: COMMENTS UPON THE FEDERAL-STATE RELATIONSHIP,**
California Univ., Berkeley.
Sho Sato.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 317-337, 1964. 21 p, 111 ref.

Descriptors: *Economics, *Water rights, *Water law, *Riparian lands, *Flow control, *Federal reservations, Reclamation, River basins, Dams, Rivers, Water use, Tributaries, Water resources, Streams, Streamflow.
Identifiers: *Pelton dam, *Navigation servitude, Laissez-faire.

This article reviews and explores briefly two Congressional powers which have served as the basis for Congressional jurisdiction over water resources. These are the power to regulate interstate commerce and the power to regulate and dispose of the property of the United States. Until now, the power granted under the commerce clause has only related to navigation. A corollary, however, introduces the issue of whether or not the plenary power of Congress over navigable streams permits interference and even destruction of existing water uses with respect to watercourses within that power without compensation. As far as the property clause is concerned, a fog enshrouds congressional disruptive power over streams, rivers, and tidewaters within the realm of public domain. Several pieces of new legislation have been proposed to end these difficulties, although a potent argument exists to avoid complete state control of these issues in favor of the economic and available through the Federal government. Recent Supreme Court decisions have held that the United States has proprietary interest in any waters in which rights are unrecognized and Congress can repeal State statutes granting such rights to reserve the water for federal control or disposition. (Murphy-Rutgers)
W70-01351

**THE ROLE OF GOVERNMENT IN A FREE SOCIETY,**
Chicago Univ., Ill.
Milton Friedman.
Controlling Pollution: The Economics of a Cleaner America, edited by M. I. Goldman, Englewood Cliffs, Prentice-Hall, p 73-81, 1967. 9 p.

Descriptors: *Government, *Economics, *Technology, Public lands, Monopoly, Resource allocation, Land, Railroads, Political aspects, Value, Prices, Legal aspects, Riparian rights.
Identifiers: *Freedom, *Neighborhood effects, *Free society, Unanimity, Market, Patents.

This article deals with the role of government and stresses that the use of political channels rarely involves a question on which the public holds a unanimous feeling. Unanimity is stressed as an ideal. Due to the fact that this ideal is not present in our society, the author suggests that the government plays a role of umpire in resolving conflicts among the freedoms of different individuals. Several freedoms are cited, including freedom to combine, freedom to compete, property rights, and the monetary system. In our free society, the organization of economic activity through voluntary exchange is supervised through governmental maintenance of law and order. In other words, government serves to determine, arbitrate and enforce the rules of the market. This article has relevance to water resource policy makers in delineating the author's view of the proper extent of government's intervention in the market economy. (Murphy-Rutgers)
W70-01355

**POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION: A COMPARATIVE STUDY OF DECISIONS,**
Syracuse Univ., N.Y.
Frank Munger, and Anne Houghton.
Water Resources Research, Vol 1, No 3, p 337-347, Third Quarter 1965. 11 p, 1 tab, 34 ref.

Descriptors: *Water resources, Decision making, Political aspects, Reservoirs, Water supply, Flood control, Benefits, Natural resources, Resource development, Surface waters, Administrative agencies, Flow.
Identifiers: *Politics, *Water resources administration, Organizational arrangements, Governmental control, Decisions, Public agency, Private agency.

This paper represents an attempt to suggest one procedure by which a number of decisions concerning resource development can be brought together and interpreted in such a way as to support generalizations about resource policy making. The area of concern is limited to water resources and is focused specifically on a relationship between political pressures and the decision as to the kind of agency, public or private, that is to administer a specific project for the control of surface flows. The paper is restricted in two principal ways. First, it is confined to water resource decisions concerning the control of surface waters and excludes both projects involving the development of groundwater and the very substantial investment in the treatment of wastes. Secondly, it focuses upon only one aspect of such decisions, the designation of the

administrative agency or enterprise that will assume the responsibility for the operation of control reservoirs. (Loeb-Rutgers)
W70-01358

**MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS,**
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-01361

**NATIONAL WATER RESOURCES ADMINISTRATION,**
Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 06B.
W70-01379

**CHEMICAL POLLUTION OF THE SEA AND THE LAW (FRENCH),**
Montpellier Univ. (France). Faculte de Droit.
For primary bibliographic entry see Field 05G.
W70-01473

**MINING AND WATER CONSERVATION.**
For primary bibliographic entry see Field 03E.
W70-01570

**RIVER BEDS.**

Pa Stat Ann Tit 64, secs 262-265 (1959).

Descriptors: *Pennsylvania, *River beds, *Minerology, *Ownership of beds, Legislation, Legal aspects, Beds, Navigable rivers, Low water mark, Mining, Iron, Coals, Limestones, Gravels, Sands, Navigation, Dams, Canals, Banks, Riparian rights, Administrative agencies, Surveys.
Identifiers: Warrants of state lands.

When application is made to the Secretary of Internal Affairs for a warrant of state land, he directs the appropriate county surveyor to survey so much of the bed of any public navigable river as is called for in the application. Specific procedures for the survey are provided. The right to dig and mine minerals vests in the warrant grantee provided: the right is not exercised so as to interfere with navigation or the rights of persons holding property on the banks of the river; and, the right is not exercised so as to undermine the bed of any river within one hundred yards of any dam, lock, or other structure erected to improve navigation. Any person holding a warrant may, within ten years after its issuance, receive a patent for the land described therein upon payment of the usual price per acre for public lands. No part of this act will be construed to grant any right to the surface of the bed of any river; but any rights acquired hereunder are confined to sinking shafts and mining beneath the beds of such rivers. (Keith-Florida)
W70-01574

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01585

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01586

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01587

**CONSERVANCY.**
For primary bibliographic entry see Field 04A.
W70-01588

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01589

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01590

**WATER POLLUTION CONTROL.**
For primary bibliographic entry see Field 05G.
W70-01591

**WATERS: SURFACE WATER DRAINAGE,**
For primary bibliographic entry see Field 04A.
W70-01592

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01593

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01594

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01595

**THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,**
For primary bibliographic entry see Field 06D.
W70-01596

**LEGISLATIVE RESTRICTIONS.**

Miss Const Art 4, secs 81, 90 (g).

Descriptors: *Mississippi, *Navigable waters, *Bridges, Legislation, Public lands, Railroads, Construction, Chutes, Fish, Fishing, Eminent domain, Watercourses, Lumbering, State governments, Transportation, Safety, Barriers, Navigation.
Identifiers: *Obstructions to navigation.

The legislature shall never authorize the permanent obstruction of any of the navigable waters of the state. The legislature may provide for the removal of any existing obstructions whenever the public welfare demands. This section shall not prevent the construction, under proper authority, of drawbridges for railroads or other roads, or the construction of booms and chutes for logs when the safe passage of vessels is not prohibited. The legislature shall not pass local, private, or special laws: (1) granting the right to have any ferry, bridge, road, or fish-trap; (2) relating to stock laws, water-courses, and fences; (3) conferring the power to exercise the right of eminent domain; and (4) granting any lands under control of the state to any person or corporation. Such matters shall be provided for only by general laws. (Schram-Florida)
W70-01597

**BRIDGES AND TUNNELS ACROSS TRIBUTARIES OF THE GULF OF MEXICO AND MISSISSIPPI SOUND.**

Miss Code Ann secs 8447-01 thru 8447-36 (1956).

Descriptors: *Mississippi, *Bridges, *Highways, *Bridge construction, Gulf of Mexico, Eminent domain, Costs, Construction, Road construction, Engineering structures, Tunnel construction, Construction costs, Cost allocation, Legislation, Legal aspects, State governments, Federal government, Financing, Project planning, Administrative agencies, Assessments, Benefits.

The state highway commission is authorized to construct and maintain bridges, tunnels, or causeways across any tidewater, bay, or river tributary of the Gulf of Mexico or Mississippi Sound. The cost of these projects may be financed by bonds. The commission may accept funds from the federal government and may exercise eminent domain to acquire bridge sites. Each project shall be regarded as part of the state highway system. A bridge district, for the purpose of constructing and operating an interstate bridge, may be established. A commission may then be appointed by the county court to plan construction of the bridge and to assess costs on the basis of benefit to landowners, both public and private. The commissioners may collect tolls for transit over the bridge. The commissioners are empowered to negotiate contracts with the federal or state governments and to acquire real estate by eminent domain. (Kelly-Florida)
W70-01598

**BRIDGE REVENUE BOND ACT.**
For primary bibliographic entry see Field 06C.
W70-01599

**NUMBERING OF UNDOCUMENTED VESSELS.**
Miss Code Ann sec 8496-03 (Supp 1968).

Descriptors: *Mississippi, *Ships, *Boats, *Boating regulations, Legislation, State governments, Federal government, Regulation, Permits, Navigable waters, Boating, State jurisdiction, Federal jurisdiction, Oceans, Foreign countries.
Identifiers: Boat registration.

Every undocumented vessel propelled by machinery in excess of ten horsepower, whether or not such machinery is the principal source of propulsion, using the territorial and navigable waters of the state must be properly numbered. In addition, every such vessel owned in this state and using the high seas must likewise be numbered. Certain specified types of vessels are excluded from this requirement. (Schram-Florida)
W70-01600

**SEA WALLS AND HIGHWAY PROTECTION.**
For primary bibliographic entry see Field 04A.
W70-01601

**SOIL AND WATER CONSERVATION.**
For primary bibliographic entry see Field 04D.
W70-01602

**GAME AND FISH.**

Miss Code Ann secs 5844, 5844-01, 5844-11, 5856, 5857, 5862, 5862.5, 5863, 5866, 5870, 5872.7, 5883.5, 5900, 5902, 5902, 5902.5, 5903, 5905, 5906, 5911.5, 5912, (1952), as amended, (Supp 1968).

Descriptors: *Mississippi, *Wildlife management, *Freshwater fish, *Fish management, Legislation, Administrative agencies, Wildlife conservation, Sport fish, Commercial fishing, Fishing, Fish stocking, Recreation, Permits, Fish farming, Bait fishing, Fishing gear, Legal aspects, Regulation.
Identifiers: *Licensing.

Powers of the Game and Fish Commission are outlined, which generally provide for the protection, distribution and regulation of wild game and fish. Duties and powers of wardens and other peace officers are established, and fines and penalties for violations of fish and game laws are prescribed. Provisions are made for fees and licenses for resident and non-resident sport fishermen, commercial fishermen, wholesale dealers, and minnow dealers. Alligators are protected, and frogs and turtles may be taken for commercial use only by license or special permit. Lawful methods of taking fish are prescribed, and certain methods are expressly prohibited. Reciprocal licensing and regula-

tions are authorized with Arkansas and Louisiana for adjoining waterbodies. (Douberley-Florida)
W70-01603

**GAME AND FISH.**

Miss Code Ann secs 5844, 5844-01, 5844-11, 5856, 5857, 5862, 5862.5, 5863, 5866 (1952), as amended, (Supp 1968).

Descriptors: *Sport fish, *Fishing, *Fish management, *Recreation, Fish, Regulation, Freshwater fish, Fish conservation, Wildlife conservation, Fish stocking, Fisheries, Administrative agencies, Permits, Flooding, Fishkill, Non-consumptive use, Wildlife management.
Identifiers: Penalties.

The Game and Fish Commission is authorized to make rules and regulations, to inaugurate surveys, and to establish services as necessary. It is empowered to vary prescribed fishing seasons if necessary for the preservation of a species, to designate protected areas, to acquire land for sport and recreation, to stock or restock lands or waters, to have exclusive control over the propagation and distribution of wild game and fish, to regulate the taking of non-game gross fish, and to issue fishing permits. The Commission may acquire lands inundated by waters behind a structure built to prevent the drying up of a natural waterbody. Duties and powers are provided for the Director of Conservation, the game and fish wardens and other peace officers. Funds collected by the Commission are used by it, except that a portion of fines collected goes to the county with jurisdiction over the violation. Fines and penalties for violations of laws and regulations are prescribed. (Douberley-Florida)
W70-01604

**GAME AND FISH.**

Miss Code Ann secs 5870, 5872.7, 5883.5, 5900, 5902, 5902.5, 5903, 5905, 5906, 5911.5, 5912 (1952), as amended, (Supp 1968).

Descriptors: *Commercial fish, *Sport fish, *Permits, *Fishing, Fish farming, Reservoir fishing, Nets, Minnows, Commercial fishing, Bait fishing, Fishing gear, Freshwater fish, Frogs, Turtles, Regulation, Fish conservation, Fish control agents.
Identifiers: Fishing permits, Alligators, Interstate cooperation.

Resident licenses are issued to citizens who have been residents in the state for six months. Wholesale minnow dealers are licensed by the Game and Fish Commission, and fees are set out for resident and non-resident dealer licenses. Frogs or turtles may not be taken for commercial use without a resident license or a special permit. It is unlawful to hunt, kill or catch alligators. Lawful means of taking game fish are specified, and the use of chemicals, explosives or electricity to take any fish is prohibited. Game fish taken by nets or seins must be immediately returned to the water. Taking of non-game gross fish in certain reservoirs and rivers may be regulated by the Commission. Game fish may not be sold unless grown in a private pond, and fish dealers may not possess game fish. Fees and regulations are provided for commercial, resident and non-resident fishing and wholesale dealer licenses. The Commission may negotiate with Arkansas and Louisiana to effectuate reciprocal regulations and licensing with relation to the Mississippi River area and the Pearl River. (Douberley-Florida)
W70-01605

**SCHROEDER V ZIEGELMAN (RIGHT TO USE OF CANAL ON ANOTHER'S PROPERTY).**
For primary bibliographic entry see Field 04A.
W70-01606

**SEIFERT V SOUND BEACH PROPERTY OWNERS ASS'N (WATER DAMAGE FROM IMPROVEMENTS ON ADJACENT PROPERTY).**
For primary bibliographic entry see Field 04C.
W70-01607

**INCORPORATION OF SANITATION DISTRICTS.**
For primary bibliographic entry see Field 05G.
W70-01608

**SURVEY OF OPERATING EXPERIENCES UNDER NEW STATE WATER LAWS,**
For primary bibliographic entry see Field 06B.
W70-01609

**POWERS OF COMMISSION OF GAME AND INLAND FISHERIES.**

Va Code Ann secs 29.11 thru 29.13 (1969).

Descriptors: *Virginia, *Administrative agencies, *Wildlife management, *Wildlife conservation, Fishing, Hunting, Regulation, Forest management, Preservation, Conservation, Fisheries, Federal government, Impounded waters, Lakes, Dams, Construction, Supervisory control (Power), Fish.
Identifiers: Fish and game preserves, Fish and game refuges.

The Commission of Game and Inland Fisheries has the power to: (1) acquire land and waters in the state for Commission purposes; (2) construct buildings, dams, lakes, and ponds necessary for game and fish preservation operations; (3) replenish and restock lands and inland waters; (4) establish fish and game refuges and preserves as well as regulations for same; (5) carry on conservation education programs; and (6) enforce all game and fish laws and regulations. The Commission controls hunting and fishing rights on all impounded water areas resulting from power development. It also controls forest areas owned by the federal government, subject to the rights of the Department of Agriculture. (McDonough-Florida)
W70-01610

**REGULATIONS REGARDING CLAMS AND SCALLOPS.**

Va Code Ann secs 28.1-160 thru 28.1-163 (1969).

Descriptors: *Virginia, *Fish management, *Shellfish, *Commercial shellfish, Clams, Commercial fishing, Permits, Fish conservation, Legislation, Legal aspects, Oysters, Administrative agencies, State jurisdiction, Water pollution, Taxes.
Identifiers: Scallops.

Every person engaged in the business of buying, marketing, and shipping scallops, clams, and bivalves, other than oysters from within the state, must pay an annual license tax. If anyone is found in possession of oysters while engaged in taking clams or scallops during the season in which taking oysters from natural rocks, beds, or shoals is prohibited, he is presumed guilty of violating the statute regulating oyster fishing. The Commissioner of Fisheries is authorized to dredge clams in polluted areas for the purpose of replanting in public clamming grounds. The commissioner may be his own authority or upon petition set aside any ground in the state's waters, not previously assigned for planting or bathing purposes, as a public clamming or scalloping grounds. A season for catching scallops, as well as a minimum size requirement, is established by the statute. (Kelly-Florida)
W70-01611

**THE NAVIGATION SERVITUDE,**
For primary bibliographic entry see Field 04A.
W70-01612

**WHARVES, DOCKS, PIERS AND BULKHEADS.**

Va Code Ann secs 62.1-164, 62.1-165.

Descriptors: *Virginia, *Docks, *Piers, *Bulkheads, Legislation, Coastal structures, Construction, Permits, Local governments, Navigation, Watercourses, Engineering structures, Judicial decisions, Administration, Decision making, Water policy, Regulation, Cities.
Identifiers: Obstruction to navigation.

Any person owning land upon a watercourse may erect a wharf, pier, or bulkhead on said watercourse; provided, navigation is not obstructed, nor the private rights of any person be otherwise injured thereby. The circuit court of the country in which such structure is located may abate the same if navigation is obstructed or any private landing is encroached upon. Any person desiring the privilege of erecting a wharf at or on any county landing may, after giving notice of his intention, present to the circuit court of the county a petition for such privilege. The court may determine the same and may, in its discretion, grant such privilege and fix such rates and charges upon such conditions and limitations as to it may seem fit. The court, at any subsequent term, may revoke such privilege, alter such conditions or limitations, or regulate the rates and charges. This section is not intended to authorize a circuit court to grant the privilege of erecting a wharf within a city. (Schram-Florida)
W70-01613

**MOTORBOATS AND WATER SAFETY.**

Va Code Ann secs 62.1-166 thru 62.1-169, 62.1-171, 62.1-173, 62.1-179, 62.1-180, 62.1-182, 62.1-184, 62.1-185 (1968).

Descriptors: *Virginia, *Boating, *Water sports, *Safety, Recreation, Public health, Boating regulations, Swimming, Water skiing, Administrative agencies, Local governments, Coast guard regulations, Legislation, Surf-boarding, Permits, Recreation facilities, Boats, State governments, Social aspects.

The declared policy of the state is to promote safety for persons and property in and connected with the use, operation, and equipment of vessels. The Commission of Game and Inland Fisheries shall enforce and administer the provisions of this chapter. All expenses required for administration and enforcement of this chapter shall be paid from the funds collected pursuant to this chapter. Every motorboat on the waters of the state must bear identification numbers. Any person owning land bordering on any waters of the state may petition the Commission to authorize the placing of markers around a public swimming area at the expense of the petitioner. A motorboat need not be numbered if it is either federally registered, a foreign vessel, lifeboat, racing boat, or under ten horsepower. Waterskiing is regulated. Skiing in public swimming areas is prohibited. Any local government may, if permitted by the Commission, make additional regulations. Provisions for the enforcement and punishment of violations of the chapter are included. (Schram-Florida)
W70-01614

**PROTECTION OF AIDS TO NAVIGATION.**
Va Code Ann secs 62.1-187 thru 62.1-189 (1968).

Descriptors: *Virginia, *Buoys, *Warning systems, *Navigation, Legislation, Ships, Anchors, Boats, Naval architecture, Lighthouses, Harbors, Boating, Safety, Boating regulations, Adjudication procedure, State governments, Accidents, Damages, Fouling, Admiralty, Transportation.
Identifiers: Navigation aids.

It is a misdemeanor for any person to: (1) moor any vessel to any buoy, beacon, or day mark; (2) willfully remove, damage, or destroy any such naviga-

tional aid; (3) cut down, remove, or damage any beacon erected on land; or (4) through unavoidable accident run down, drag from its position, or in any way injure any buoy, beacon, or day mark and fail to give notice as soon as practicable to the harbor master, other legal manager of the port, or to the United States Coast Guard. Upon conviction of such violations, the offender shall be fined not more than two hundred dollars or imprisioned not more than three months or both. The cost of repairing or replacing any such buoy, beacon, or day mark, when the cause of same has been legally ascertained, shall be a lien upon the vessel causing the damage. It is a misdemeanor punishable by not more than fifty dollars to anchor any vessel on the range of any range light unless such anchorage is unavoidable. (Schram-Florida)
W70-01615

**COMPACT AND BOUNDARY BETWEEN VIRGINIA AND MARYLAND.**

Va Code Ann sec 7.1-7 (1966).

Descriptors: *Virginia, *Maryland, *Boundaries (Property), *State jurisdiction, Legislation, Boundary disputes, Legal aspects, Political aspects, Navigation, State governments, Interstate compacts, Interstate rivers, Fish conservation, Water conservation, Channel improvement, Riparian rights, Public benefit.

The 1785 compact between Virginia and Maryland remains obligatory except so far as it may have been superseded by the provisions of the United States Constitution. The compact provides that citizens of each state shall have full property rights in the shores of the Potomac adjoining their lands. Fishing rights are to be common and equal to citizens of both states. Mutual statutes shall be made for the preservation of fish, preserving the channel, and maintaining navigation in the Potomac. Jurisdiction for piracies, crimes, and offenses committed in the waters dividing the states is discussed in detail. The boundary line between Virginia and Maryland, established in 1878, is described in detail. This also is declared to be still in effect and binding upon the states and the citizens thereof. Numerous provisions for mutual jurisdiction, the reach of process into the adjoining state, and property disputes are outlined. (Schram-Florida)
W70-01616

**CROSSINGS AND CONNECTIONS.**
Va Code Ann secs 56-16, 56-17, 56-32, 56-34 (1969).

Descriptors: *Virginia, *Canals, *Roads, *Utilities, Industries, Canal construction, Highways, Streams, Administrative agencies, Administration, Judicial decisions, Industrial water, Local governments, Governments, Legislation, Public utilities, Obstruction to flow.

Every public service corporation whose canal passes through any person's land shall provide a suitable wagonway across such canal upon written request of the landowner. Failure to provide a wagonway within ten days after request, enables the landowner to apply to the circuit court of the county to have a board of commissioners appointed to decide if a wagonway should be constructed. The company shall be fined five dollars per day for failure to provide such wagonway as ordered. A public service corporation may cross the canal of another such corporation. However, such crossing shall in no way impair operations of the canal to be crossed. No state highway, county road, stream, or watercourse shall be altered, closed, or obstructed by any public service corporation without the approval of the State Highway Commissioner and any other governing body involved. Such corporation shall provide a highway or waterway in lieu of the one so altered or closed. The General Assembly reserves the right to connect any company's canal with any other company's canal. (Smith-Florida)
W70-01617

**HARBORS AND HARBOR LINES.**
RI Gen Laws Ann secs 46-4-1 thru 46-4-8 (1956), as amended, (Supp 1968).

Descriptors: *Rhode Island, *Harbors, *Tidal waters, *Local governments, Coastal engineering, Navigation, Coasts, Planning, Regulation, Port authorities, Boats, Ships, State jurisdiction, Transportation, Legislation, Legal aspects, Administrative agencies, Administration.
Identifiers: Harbor lines.

After holding prescribed public hearings, the Director of Public Works may mark out and plot harbor lines to be established in any of the state's public tidewaters. The recommended harbor lines must be approved by the governor and senate before they become effective. The council of any municipality is authorized to appoint a harbor master for harbors within its jurisdiction. The city of Providence is given an expanded jurisdiction for purposes of this statute. Specific towns are authorized to regulate speed, management, and control of all vessels within their respective boundaries by ordinance. These towns may also regulate the size, type, location, and use of all anchorages and moorings within their respective harbors. None of the powers granted to municipalities by the statute are deemed to supercede the authority of the state Director of Public Works over the public tidewaters of the state. (Kelly-Florida)
W70-01618

**DEVELOPMENT, CONSERVATION AND USE OF WATER RESOURCES.**
For primary bibliographic entry see Field 06B.
W70-01619

**FOREST GAME FISH AND RECREATION RESERVES.**

Va Code Ann secs 10-22 thru 10-26, 10-31 (1964).

Descriptors: *Virginia, *Forest management, *Administration, *Wildlife management, Forests, Land use, Lumbering, Recreation, Hunting, Fishing, Land development, Land management, Permits, Income, Operating costs, Taxes, Administrative agencies, Governments, Legislation.

The owner of any forest or timber land may offer the same, subject to pasturage, to the Department of Conservation and Development as a forest, game, and recreation reserve. If such land is accepted by the State Forester, the owner shall deliver a written lease to the Director, leasing the land and all hunting, fishing, and recreational rights to Virginia until the timber thereon shall become suitable for marketing as lumber. The State Forester shall aid in the development and protection of such lands. The Commission of Game and Inland Fisheries is authorized to sell hunting, fishing, and limited recreational privileges on any reserve so created. All funds accrued from the sale of privileges on such reserves shall be paid into a state fund to be used for the administration, protection, development, and taxation of the reserve lands. No tax or local levy shall be paid unless the owner desires to do so. Such taxes shall be deferred until such time as the timber on the reserve is marketed. The Director and the Commission are authorized to promulgate and enforce rules and regulations governing the reserve. (Smith-Florida)
W70-01620

**LOCAL FLOOD PREVENTION AND WATER SUPPLY.**
For primary bibliographic entry see Field 04A.
W70-01621

**PUBLIC UTILITIES AND POLLUTION PREVENTION.**
For primary bibliographic entry see Field 05G.
W70-01622

**ZONING.**
For primary bibliographic entry see Field 06F.
W70-01623

**WATER POLLUTION CONTROL BY MUNICIPALITIES.**
For primary bibliographic entry see Field 05G.
W70-01624

**FEDERAL ROLE IN POLLUTION CONTROL,**
For primary bibliographic entry see Field 05G.
W70-01625

**PERMANENT JOINT COMMITTEE ON WATER RESOURCES.**
For primary bibliographic entry see Field 06B.
W70-01626

**WATER AND WATER COURSES - LANDLOCKED NON-NAVIGABLE LAKES - OWNERS RESTRICTED TO REASONABLE USE.**
For primary bibliographic entry see Field 06D.
W70-01627

**DAMAGES FROM MILLDAMS.**
For primary bibliographic entry see Field 04A.
W70-01628

**INSPECTION OF DAMS AND RESERVOIRS.**
For primary bibliographic entry see Field 04A.
W70-01629

**INTERTIDAL SALT MARSHES.**
For primary bibliographic entry see Field 06G.
W70-01630

**THE TAKING OF QUAHAUGS AND CLAMS.**
R I Gen Laws Ann secs 20-11-1 thru 20-11-5, 20-11-7 thru 20-11-13 (1968).

Descriptors: *Rhode Island, *Shellfish, *Commercial shellfish, *Clams, Permits, Regulation, Boats, Administrative agencies, Commercial fish, Legislation, Legal aspects, State governments, Fish harvest, Fish management, Wildlife management, Fish conservation, Fishing gear, Commercial fishing.
Identifiers: Quahaugs.

The taking or possession of quahaugs under the minimum size is unlawful. No person may, unless duly licensed, take quahaugs or clams by dredges, rakes, or other apparatus operated by mechanical power or hauled by boat. Licenses for the dredging of quahaugs may be obtained from the Director of Natural Resources in accordance with the procedures herein provided. Boats used in quahaug dredging must be registered. This act establishes a maximum daily take on quahaugs and also provides for: (1) the opening of areas for dredging; (2) areas permanently closed; (3) the unlawfulness of carrying power apparatus during closed season; (4) the disciplinary suspension of boat registration; (5) suspension of dredging licenses; (6) penalties for violation of this act including the impoundment of boats; and (7) the assessment of the costs of seizure and impoundments of boats. (Marsee-Florida)
W70-01631

**SEINES, NETS AND WEIRS.**

R I Gen Laws Ann secs 20-19-1 thru 20-19-28 (1968).

Descriptors: *Rhode Island, *Fish management, *Interstate compacts, *Administration, Regulation, Nets, Weirs, Dams, Gill nets, Trapping, Rivers, Ponds, Channels, Islands, Connecticut, Management, Fish, Fish conservation, Wildlife management, Fishing, Water sports, Administrative agencies, Governments.

Regulations regarding the use of seines, nets, or other contrivances are established for specifically named bodies of water. A compact with Connecticut governing fishing in the Pawcatuck River is established. Any owner of land adjoining the Pawcatuck River who allows certain named violations of said compact to occur on his land is liable as though he had committed such violations. The Department of Natural Resources has general supervisory and regulatory powers in all matters relating to this chapter. The Director of the Department may co-operate with agencies of other states and makes an annual report to the general assembly. (Smith-Florida)
W70-01632

**FRESH WATER FISHING.**
R I Gen Laws Ann secs 20-21-1 thru 20-21-21 (1968).

Descriptors: *Rhode Island, *Fish management, *Fish conservation, *Regulation, Control, Fishing, Fish, Fish harvest, Wildlife conservation, Spawning, Fish reproduction, Permits, Administration, Administrative agencies, Trout, Bass, Rivers, Ponds, Streams, Legislation, Bait fishing, Ice fishing, Equipment, Commercial fishing, Sport fishing, Nets, Fisheries, Fishing gear, Fish stocking.

With certain exceptions, closed seasons, maximum daily catches, and a minimum size are established for game fish. The purchase and sale of certain varieties of fish is prohibited. Unless privately owned, no stream or pond may be stocked without approval of the Department of Natural Resources. Placing any substance injurious to fish in any stream or pond is prohibited, except as otherwise provided by law. Methods of catching fish and equipment used therefore are regulated. (Smith-Florida)
W70-01633

**MINNOWS; RECIPROCAL ENFORCEMENT OF FISHING LAWS.**
R I Gen Laws Ann secs 20-22-1 thru 20-22-8, 20-23-1 (1968).

Descriptors: *Rhode Island, *Minnows, *Fish management, *Interstate compacts, Interstate rivers, Control, Animal control, Fishing, Nets, Weirs, Management, Permits, Fish, Wildlife conservation, Spawning, Fish reproduction, Administration, Administrative agencies, Regulation, Baits, Bait fishing, Legislation, Bait traps, Supervisory control (Power), Fish conservation, Water resources development.

A license is required to engage in the minnow business or to possess more than one hundred live freshwater minnows at one time. Lawful methods for taking freshwater minnows are set out. The Director of Natural Resources is authorized to make additional regulations concerning the methods, times, numbers, and seasons for taking freshwater minnows. There is provision for interstate cooperation in the enforcement of fishing laws. (Smith-Florida)
W70-01634

**CONDEMNATION FOR WATER SUPPLY PURPOSES.**
R I Gen Laws Ann sec 39-15-1 (1956).

Descriptors: *Rhode Island, *Condemnation, *Water supply, *Local governments, Dams, Water, Water demand, Water requirements, Water works, Water resources, Water resources development, Eminent domain, Right-of-way, Legislation, Contracts, Supply contracts, Reservoirs, Pumping, Pumping plants, Highways, Highway relocation, Bridges, Bridge construction.

Whenever the electors of any town have voted to provide a water supply for the inhabitants of such town, or whenever any town has made contracts for such a water supply, then such town, or the party bound to fulfill such contract, may take, condemn, hold, use, and permanently appropriate any land, water, rights of water and of way, necessary for furnishing or enlarging any such water supply, including sites and materials for dams, reservoirs, pumping stations, and coal houses, with right-of-way across public or private lands, including lands to be covered by water. The grade of any highway may be altered and bridges therein built for the accomodation of such water supply. (Smith-Florida)
W70-01635

**WATER FENCES.**
R I Gen Laws Ann secs 34-10-6 thru 34-10-8 (1956).

Descriptors: *Rhode Island, *Barriers, *Marshes, *Animal control, Limiting factors, Tidal marshes, Ocean water, Cattle, Sheep, Domestic animals, Riparian rights, Riparian land, Control, Regulation, Land use, Legislation, Legal aspects.
Identifiers: Water fences, Trespass.

Coterminous owners or possessors of land adjoining water, whenever their land is under improvement, shall maintain a sufficient water fence to prevent trespass by cattle in the same manner as other partition fences are directed by this chapter. All tracts of marshland so exposed to the sea as to render partition fences impracticable are exempt from this chapter. The owner of any marshland so exempted has the remedies for trespass provided in other cases if any person permits his cattle, sheep, horses, or hogs to run upon such marshland. (Smith-Florida)
W70-01636

**SOVEREIGNTY AND STATE JURISDICTION; COUNTY JURISDICTION.**

R I Gen Laws Ann secs 42-1-1, 42-1-3, 42-3-6 (1956).

Descriptors: *Rhode Island, *State jurisdiction, *Boundaries (Property), *High water mark, Jurisdiction, Federal jurisdiction, Legal aspects, Governments, Legislation, Shores, Coasts, National seashores, Boundaries (Surfaces), Local governments, Bays, Waters, Rivers, Streams.
Identifiers: Headlands.

The territorial limits of this state extend one marine league from its seashore at high water mark. When an inlet does not exceed two leagues between its headlands, a straight line from one headland to the other is equivalent to the shore line. Certain tracts are ceded to the United States, some of which border on waters of the state. With enumerated exceptions, jurisdiction of counties separated by or bordering on public waters is concurrent over such waters. (Smith-Forida)
W70-01637

**THE RHODE ISLAND DEVELOPMENT COUNCIL.**
For primary bibliographic entry see Field 06B.
W70-01638

**MAINTENANCE OF TOWN HIGHWAYS.**
For primary bibliographic entry see Field 04C.
W70-01639

**HIGHWAYS: DRAINAGE OF SURFACE WATER.**
For primary bibliographic entry see Field 04A.
W70-01640

**POWERS OF THE TURNPIKE AND BRIDGE AUTHORITY.**

R I Gen Laws Ann sec 24-12-9-s (1956).

Descriptors: *Rhode Island, *Administrative agencies, *Right-of-way, *Data collections, Surveys, Sounding, Drilling, Civil engineering, Inspection, On-site data collections, Terrain analysis, Condemnation, Eminent domain, Highways, Bridges, Administration, Governments, Legislation.

The Turnpike and Bridge Authority may enter upon any lands, waters and premises to make such surveys, soundings, borings and examinations as the Authority may deem necessary or convenient for its purposes. Such entry shall not be deemed a trespass nor shall such entry be deemed an entry under any condemnation proceedings. The Authority must pay for any actual damages resulting from such an entry. (Smith-Florida)
W70-01641

## 6F. Nonstructural Alternatives

**CAN ECOLOGY PROVIDE THE BASIS FOR SYNTHESIS,**
Wisconsin Univ., Madison. Lab. of Limnology.
Arthur Hasler.
Social Sciences and the Environment, Colorado University Press, 1967. p 42-45.

Descriptors: *Ecology, *Environment, *Synthesis, *Environmental effects, Eutrophication, Limnology, Reservoirs, Water pollution effects, Planning, Water pollution control.
Identifiers: Social science, Physical science, Resource management, Evolution, Water resources management, Weather modification, Species extinction, Blue whale, Religious influence, Italy, Madison (Wis), Lake Washington (Wash), Lake Tahoe (Calif-Nev), Lake Zurich (Switz), Lake Baikal (USSR), Lake Wingra (Wis), Lake Mendota (Wis), Lake Monona (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis).

Throughout history man has modified his environment. Today he faces the price of some of these modifications; extinction of animal species (blue whale and others), deterioration of water quality, flood damage resulting from poor agricultural practices, to mention only a few. More research is needed to solve some of the national and international problems regarding man-made environments, but in many aspects sufficient technology is available to reverse such effects if we had the economic capacity and laws to initiate action. Author feels that, where scientists and mass communications media are lacking, there exists a role for the church, through personal contact, in influencing people to re-evaluate adverse effects of outdated techniques of land management. There is a great lack of communication between scientific disciplines which could prevent future mistakes by presenting viable alternatives to present techniques. Although man-induced changes in the environment will necessarily occur, ecologists have knowledge and techniques which can be used to diminish destructive and deteriorative processes, can suggest alternatives and can work cooperatively with other scientists to find better solutions. (Ketelle-Wisconsin)
W70-01582

**ZONING.**

Va Code Ann secs 15.1-486, 15.1-489, 15.1-490 (1964), as amended, (Supp 1968).

Descriptors: *Virginia, *Zoning, *Resource development, *Local governments, Water policy, Water resources development, Water resources, Administration, Cities, Conservation, Flood plain zoning, Governments, Natural resources, Planning, Resources, Water conservation, Flood plains, Flood protection, Flood control, Land use, Sewage, Regulation, Legislation.

The governing body of any county or municipality may divide its territory into districts, and each district may regulate, restrict, permit, prohibit, and determine the following: (1) the use of land, buildings, structures, and other premises for

agricultural, commercial, industrial, residential, flood plain, and other purposes; (2) the size, location, construction, or removal of structures; (3) the areas and dimensions of land, water, and air space to be occupied by structures and uses, and of open spaces to be left unoccupied, based on whether a public or community water supply or sewer system is available and used; and (4) the excavation of natural resources. Zoning ordinances shall be for the general purpose of promoting the public health, safety, or general welfare. To these ends such ordinances shall provide adequate safety from fire, flood, and other dangers, and shall expedite the provision of adequate water, sewage, flood protection, and other public requirements. Such districts shall be drawn with reasonable consideration for the conservation of natural resources, and preservation of flood plains. (Smith-Florida)
W70-01623

## 6G. Ecologic Impact of Water Development

**INTERTIDAL SALT MARSHES.**
R I Gen Laws Ann secs 11-46.1-1 (Supp 1967).

Descriptors: *Rhode Island, *Fishing, *Tidal marshes, *Balance of nature, Legislation, Legal aspects, Marshes, Coastal marshes, Salt marshes, Intertidal areas, Fish, Fish conservation, Shellfish, Nitrates, Phosphates, Plankton, Organic compounds, Permits, Natural resources, Regulation, Marsh plants, Administrative agencies, Ecology, Excavation, Water pollution, Pollution abatement.
Identifiers: *Intertidal salt marshes, Penalties (Criminal).

The state constitution guarantees the right to fish. This right cannot be enjoyed unless fish and shellfish can be found in abundance. The metabolism and katabolism of plants and animals found in salt marshes furnishes the nitrates, phosphates, sugars, plankton, and organic chemicals necessary for the nuture of fish and shellfish. The salt marshes of the state are in jeopardy of despoliation. To remedy the foregoing state of affairs it is resolved that any person who dumps or deposits mud, dirt, or rubbish on, or who excavates and disturbes the ecology of intertidal salt marshes without first obtaining a permit from the department of natural resources will be fined. For the purposes of this chapter, an intertidal salt marsh is described in terms of enumerated plants which grow thereon. The director of natural resources will refuse to issue a permit if in his judgement the end result would be the disruption of the ecology of a salt marsh. (Keith-Florida)
W70-01630

# 07. RESOURCES DATA

## 7A. Network Design

**THE DEFINITION OF THE TERMS HYDROLOGICALLY ARID AND HUMID FOR AUSTRALIA,**
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
J. R. Watkins.
J Hydrol, Vol 9, No 2, p 167-181, Oct 1969. 15 p, 9 fig, 5 tab, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Arid lands, *Classification, *Climatic zones, Precipitation (Atmospheric), Runoff, Water yield, Temperature, Hydrology, Groundwater, Geomorphology, Evaporation.
Identifiers: *Australia, Aridity classification.

The importance of using runoff data as a measure of aridity is emphasized. If aridity is defined in terms of annual runoff, a direct relationship will then exist between the behavior of surface storages, groundwater hydrology and geomorphic landform process. Stream gage data and simple methods of estimation from either precipitation and evaporation or precipitation and temperature data are discussed for Australian stations. A classification into four main zones of varying hydrologic aridity is proposed. (Knapp-USGS)
W70-01267

**RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SECTION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),**
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
F. Bultot, and G. L. Dupriez.
Brussels Institut Royal Meteorologique de Belgique, 1968. 32 p, 1 fig, 13 tab, 3 append.

Descriptors: *Instrumentation, *Hydrometry, *Hydrologic data, *Data processing, *Networks, Stations, Air temperature, Winds, Gages, Humidity, Water temperature, Precipitation (Atmospheric), Water level fluctuations, Discharge (Water), Evaporation.
Identifiers: *Belgian Royal Meteorological Institute.

This monograph describes a method of recording and processing hydrometeorological and hydrological data used by the Royal Meteorological Institute of Belgium. The discussion includes: gaging station net; data processing (temperature, humidity, precipitation, water level); data storage; data utilization; semiautomatic reader for scanning conventional climatological maps; tables of air temperature, humidity, pressure, precipitation, and water discharge; and the tables of hydrometeorological data, depth of runoff, and the distribution of hourly, monthly, and annual precipitation. (Gabriel-USGS)
W70-01284

**DRAINAGE NETWORK ANALYSIS WITH K-BAND RADAR IMAGERY,**
Kentucky Univ., Lexington. Dept. of Geography.
Roger M. McCoy.
Geogr Rev, Vol 59, No 4, p 493-512, Oct 1969. 20 p, 11 fig, 3 tab, 10 ref. NASA Contract No 17-0004-003 and NASA Grant NsG-298.

Descriptors: *Drainage, *Drainage systems, *Radar, *Surface drainage, Mapping, Aerial photography, Clouds, Rain, Watersheds (Basins), Hydrologic data, Geomorphology, Instrumentation, River basins, Slopes, Stations, Mathematical studies, Topography, Lakes.
Identifiers: *K-band radar imagery, Drainage network.

The author describes in detail the use of radar techniques for drainage network analysis. Radar-image and map presentation comparison and the evaluation of the capabilities of the radar-imagery methods are also given. Radar imagery is especially suitable for reconnaissance studies of landforms where large coverage and great detail relative to image scale is desired. For example, a K-band image of terrain 10 mi wide has a scale of 1:200,000, but the drainage data available from the image is equal to that from a 1:62,500 topographic map. (Gabriel-USGS)
W70-01427

## 7B. Data Acquisition

**THE CALCULATION OF NON-PARALLELISM OF GAMMA ACCESS TUBES, USING SOIL SAMPLING DATA,**
Institute for Land and Water Management Research, Wageningen (Netherlands).
P. E. Rijtema.
J Hydrol, Vol 9, No 2, p 206-212, Oct 1969. 7 p, 3 tab, 1 ref.

Descriptors: *Nuclear moisture meters, *Gamma rays, *Calibrations, Soil moisture meters, Instrumentation, Density, Soil moisture, Soil water.
Identifiers: Gamma-ray moisture meters, Access tubes.

An equation has been derived to determine the errors due to non-parallelism of gamma access tubes with the aid of soil sampling data, taken from the direct environment of the measuring spot. It is shown that the determination of the change in moisture content is not very sensitive to errors due to non-parallelism. When the absolute values of moisture content are needed, it is always necessary to determine the errors due to non-parallelism of the access tubes. (Knapp-USGS)
W70-01262

**SOLVING MULTI-WELL, RIVER GROUND WATER FLOW PROBLEMS,**
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-01263

**SOIL MOISTURE MEASUREMENT BY THE GAMMA TRANSMISSION METHOD,**
Institute for Land and Water Management Research, Wageningen (Netherlands).
A. H. Ryhiner, and J. Pankow.
J Hydrol, Vol 9, No 2, p 194-205, Oct 1969. 12 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Nuclear moisture meters, *Gamma rays, *Calibrations, Soil moisture meters, Instrumentation, Density, Soil moisture, Soil water.
Identifiers: Gamma-transmission soil moisture meters.

A discussion is given of the use of the gamma transmission method for the measurement of soil moisture variations. It is shown that a single calibration curve can be used for very different soils. An approach is presented for the determination of the build-up factor of scattered radiation and for the instrumental resolution time. It appeared possible to calculate the systematic errors due to non-parallelism of the access tubes. (Knapp-USGS)
W70-01265

**INTERFLOW OR SHALLOW PHREATIC FLOW IN THE COASTAL PLAIN OF GEORGIA,**
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center, and Georgia Agricultural Experiment Station, Athens.
For primary bibliographic entry see Field 02G.
W70-01266

**PRACTICAL UTILIZATION OF A NEUTRON SOIL-MOISTURE METER FOR HYDROLOGIC MEASUREMENTS: INITIAL RESULTS OBTAINED FROM AN INCLINED BASIN OF TAFAINA, REPUBLIC OF MADAGASCAR (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02G.
W70-01280

**REEVALUATING THE MEASUREMENTS OF SOLID DISCHARGES IN SUSPENSION, REPUBLIC OF CHAD (FRENCH),**
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02J.
W70-01281

**RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SEC-**

**TION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),**
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
For primary bibliographic entry see Field 07A.
W70-01284

**THERMAL NEUTRON SCATTERING MEASUREMENTS IN WATER,**
Gulf General Atomic, Inc., San Diego, Calif.
For primary bibliographic entry see Field 01A.
W70-01296

**SEEPAGE DETECTION BY REMOTE SENSING,**
HRB Singer, Inc., State College, Pa. Radiometric Lab.
Thomas R. Ory.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 128-133, 1969. 6 p, 4 fig, 2 tab.

Descriptors: *Seepage, *Canal seepage, *Remote sensing, Radar, Infrared radiation, Aerial photography, Water temperature, Evaporation, Solar radiation.
Identifiers: Seepage detection.

A number of remote sensing techniques have been shown to have application in the detection and evaluation of seepage. Radar and infrared sensors are presently available for use in seepage detection research and, to a limited extent, for operational work. When these sensors are used after a careful analysis of the detection problem, and with utilization of the information available from conventional techniques, the success probability of remote seepage detection should be very good. Future research will undoubtedly yield less expensive and more reliable remote sensors for this application as the payoffs from initial employment begin to stimulate their use. (Knapp-USGS)
W70-01423

**A DEEP-SEA ELECTRICAL RESISTIVITY PROBE FOR MEASURING POROSITY AND DENSITY OF UNCONSOLIDATED SEDIMENTS,**
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 02L.
W70-01429

**SEISMIC ATTENUATION OF GULF COAST SEDIMENTS,**
Esso Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 02L.
W70-01432

**PHYSICAL PROPERTIES OF MARINE SEDIMENTS AS RELATED TO SEISMIC VELOCITIES,**
Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 02L.
W70-01433

**METEOROLOGICAL APPLICATIONS OF REFLECTED RADIANCE MEASUREMENTS FROM ATS 1 AND ATS 3,**
Wisconsin Univ., Madison. Space Science and Engineering Center.
Thomas H. Vonder Haar.
J Geophys Res, Vol 74, No 23, p 5404-5412, Oct 20, 1969. 9 p, 6 fig, 1 tab, 9 ref.

Descriptors: *Meteorology, *Meteorological data, *Radiation, *Satellites (Artificial), *Instrumentation, Cameras, Analog models, Digital computers, Photogrammetry, Sampling, Mapping, Clouds, Cloud physics.
Identifiers: Satellite reflected-radiance measurement.

Relative and absolute values of reflected radiance on a nearly continuous basis during the daytime over a large region of the earth's surface were evaluated using the satellites ATS-1 and ATS-3 to measure the sun-reflected energy. High resolution and a wide dynamic range of the satellite-borne cameras offer new possibilities for meteorological reasearch. (Gabriel-USGS)
W70-01436

**NITRATE DETERMINATION IN SOIL EXTRACTS WITH THE NITRATE ELECTRODE,**
Norges Landbrukshoegskole, Vollebekk. Inst. of Soil Science; and Norges Landbrukshoegskole, Vollebekk. Chemical Research Lab.
For primary bibliographic entry see Field 02K.
W70-01437

**OCEANOGRAPHIC PROFILING WITH IMPROVED VERTICAL RESOLUTION,**
Hawaii Inst. of Geophysics, Honolulu.
Volker Graefe, and Brent Gallagher.
J Geophys Res, Vol 74, No 23, p 5425-5431, Oct 20, 1969. 7 p, 4 fig, 5 ref.

Descriptors: *Oceanography, *Profiles, *Instrumentation, Ships, Isotherms, Electronic equipment, Salinity, Water temperature, Hydrographs, Water properties.
Identifiers: Oceanographic profiling.

Two techniques have been developed for obtaining high-resolution vertical profiles of oceanographic variables. The methods increase the spatial resolution of lowered sensors by removing the influence of vertical ship motions. Both telemetry and retrieval are accomplished easily. Used with the STD recorder, the methods allow the resolution of features whose vertical extent is a few decimeters. This permits smaller, laterally homogeneous layers to be distinguished and contrasted with morphological features intersecting isopycnal and isothermal surfaces and will make possible more comprehensive surveys of physical microstructure. (Gabriel-USGS)
W70-01445

**PRETREATMENT PLANT FOR WOOL FACTORY EFFLUENT: WEAR AND TEES RIVER BOARD.**
For primary bibliographic entry see Field 05D.
W70-01500

## 7C. Evaluation, Processing and Publication

**TEMPERATURE OF SURFACE WATERS IN MONTANA,**
Geological Survey, Helena, Mont.
Fern C. Aagaard.
Montana Fish and Game Dep Rep, 1969. 613 p, 4 fig, 3 tab.

Descriptors: *Water temperature, *Montana, *Streams, *Lakes, *Data collections, Streamflow, Water quality, Missouri River, Gaging stations, Hydrologic data.
Identifiers: *Montana Fish and Game Commission, Upper Columbia River basin, Hudson Bay basin, Fishlife.

This publication is a compilation, in tabular and graphic form, of all available surface water temperature data in the State of Montana through 1965. The data were obtained from Federal and State Agencies, cities and private industries. The report includes records of water temperatures at 272 sites on streams and lakes ranging from spot observations at time of discharge measurements or water quality samples to continuous record by a recording thermograph. Copies are available from the Montana Fish and Game Department, Helena, Mont. (Aagaard-USGS)
W70-01250

**RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SECTION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),**
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
For primary bibliographic entry see Field 07A.
W70-01284

**SUBSURFACE IMPLICATIONS FROM SURFACE HYDROGRAPH ANALYSIS,**
Georgia Inst. of Tech., Atlanta. School of Engineering.
For primary bibliographic entry see Field 02A.
W70-01421

**SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,**
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W70-01424

**ORCENT - A DIGITAL COMPUTER PROGRAM FOR SATURATED AND LOW SUPERHEAT STEAM TURBINE CYCLE ANALYSIS,**
Oak Ridge National Lab., Tenn.
H. I. Bowers.
Report ORNL-2395, Jan 1969. 89 p, 6 fig.
Identifiers: *Programs (Computers), *Steam cycle, *Turbines, AEC sponsored, Coupling (Reactor-desalting plant), Dual-purpose plant, Feedwater heating, Flowsheets, Heat balance, Nuclear desalination, Single-purpose plant, Turbine-generators.

The program will perform full-load, design point calculations for steam turbine cycles supplied with throttle steam characteristic of contemporary water reactor power plants and will handle both condensing and back-pressure turbine exhaust arrangements. Turbine performance calculations are based on the General Electric Company method for large steam turbine-generators operating with saturated and low superheat throttle steam. Output includes all information normally shown on a turbine cycle heat balance diagram. The program is written in FORTRAN IV for the IBM 360/75 computer at Oak Ridge National Laboratory.
W70-01529

# 08. ENGINEERING WORKS

## 8A. Structures

**COST STUDY OF PRODUCT WATER CONVEYANCE AND ELECTRIC POWER TRANSMISSION FOR LARGE NUCLEAR DUAL-PURPOSE PLANTS.**
Parsons Ralph M. Co., Los Angeles, Calif.

Report prepared for ORNL Under Subcontract 2863, Aug 1967. 130 p, 43 fig.
Identifiers: *Canals, *Pipelines, *Power transmission costs, *Water conveyance, *Water conveyance costs, Capitalized costs, Construction costs, Dual-purpose plant economics, Economic evaluations, Fixed charge rate, Offshore island sitting, Operating costs, Parametric studies, Power transmission systems, Right-of-way acquisition, Seawater intake and discharge systems, Site selection criteria.

Graphs are given for the costs for conveying product water from a plant to a delivery point from 0 to 100 miles away as a function of the important variables that determine these costs. Water lifts of 0 to 1500 ft and flows of 100 to 1000 mgd are considered. Similar curves are given for seawater intake and discharge lines. A general commentary covers open canals, pressure and nonpressure pipes, tunnels, land requirements, site locations.

and intake and discharge systems. The cost of electric power transmission from the plant to a load center is given graphically for 250- to 2500-mw plants for distances of 0 to 100 miles.
W70-01564

## 8B. Hydraulics

**ON THE PENETRATION OF A TURBULENT LAYER INTO STRATIFIED FLUID,**
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
H. Kato, and O. M. Phillips.
Journal of Fluid Mechanics, Vol 37, Part 4, p 643-655, (1969). 9 ref, 6 fig.

Descriptors: *Stratification, *Turbulence, Model studies, Winds.
Identifiers: Entrainment.

The aim of this study was to explore the possibility of generating a turbulent layer not by direct stirring but by the application of a known horizontal stress at the upper ('free') surface of a stratified fluid and to make preliminary measurements of the rate at which the layer penetrates into the underlying fluid. The model was an annular tank at the surface of which a constant stress could be applied in the circumferential direction. The development of the turbulent layer by entrainment of the underlying fluid is described and it is found that the entrainment coefficient E, the ratio of the entrainment velocity u sub e to the friction velocity u sub * is given in terms of the depth D of the mixed layer and the density jump delta (rho) across the entrainment interface by the relation: E= (u sub e)/ (u sub*)= 2.5 (rho sub o) (u sq sub*)/g (delta) (rho)D. The form of these results is consistent with those found by Turner with an agitation tank, but the parameters used here allow direct application to entrainment in the ocean. (Guerrero-Vanderbilt)
W70-01383

**JET DIFFUSION IN THE REGION OF FLOW ESTABLISHMENT,**
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
Sedat Sami, Thomas Carmody, and Hunter Rouse.
Journal of Fluid Mechanics, Vol 27, Part 2, p 231-252, 1967. 24 fig, 21 ref.

Descriptors: *Jets, *Diffusion, *Turbulence, *Flow, Nozzles, Turbulent flow, Flow measurement, Flow profiles.
Identifiers: Mean flow equation.

The purpose of this study was to study the mean flow and the turbulence characteristics of a diffusing jet through the measurements of all the terms of the mean energy equation for the diffusing jet. A nozzle diameter of 1.0 ft. with an efflux velocity of about 35 ft/sec was used to determine the flow characteristics. Four types of probes were used: a static tube for mean ambient pressure; a single wire anemometer probe, for the axial components of the mean velocity and of the fluctuation, the autocorrelation, the dissipation length, and the intermittency factor; a cross wire anemometer probe, for both the axial and radial components of the mean velocity, the three (axial, radial, and tangential) components of the fluctuation, and the turbulent shear; and a piezo-electric ceramic probe was developed for the measurement of the pressure fluctuation. Also in the measurements was included the temporal mean gradient. Hot wire and pressure-probe transverses were carried out at sections with x/D ratios from 1 to 20. Conclusions were: (a) The fluctuating-pressure and turbulence-intensity fields were observed to be closely similar in form, (b) A detailed evaluation of all the terms of the momentum and mean-energy equations for the region of flow establishment, in both integral and differential forms, indicates that a satisfactory representation of the mean flow is now at hand. (Guerrero-Vanderbilt)
W70-01387

**AN EXPERIMENTAL STUDY OF TURBULENCE IN A DENSITY-STRATIFIED SHEAR FLOW,**
Manchester Univ. (England). Dept. of the Mechanics of Fluids.
C. A. G. Webster.
Journal of Fluid Mechanics, Vol 19, p 221-245, (1964). 19 ref, 24 fig, 4 tabl.

Descriptors: *Density stratification, *Turbulence, *Winds, *Flow measurement, Conductivity, Viscosity, Shear, Wind velocity.
Identifiers: *Richardson number.

The purpose of this study was the investigation of turbulence in the density stratified shear flow of a specially designed wind tunnel in which the density gradient is created by differential heating of the air. The heated shear-flow wind tunnel is a small tunnel, nominally 0.5 m. square in section in which essentially linear temperature and velocity gradients extend over an appreciable depth of the flow. Mean temperature and temperature gradients were measured using thermometers and thermocouples, and a method of measuring low wind speeds based on the periodic shedding of vortices by a circular cylinder was discussed and used. Also, a hot-wire anemometer was used. The characteristics measured were the stream-wise and vertical components of the turbulence together with the temperature fluctuation at the same point. Conclusions were: (a) The experiments have produced much new information concerning the variation with stability of the various quantities associated with turbulence and turbulent transport processes, and at the same time indicating the possibility of a detailed study of these flows. (b) It was not possible to attain steady state conditions. The indications were that a doubling, or even a trebling, of the linear dimensions of the apparatus would be necessary to do so. (c) The results obtained serve to confirm that the ratio (Eddy conductivity/Eddy viscosity) falls with increasing Richardson number. (Guerrero-Vanderbilt)
W70-01389

**TURBULENT BUOYANT CONVECTION FROM A SOURCE IN A CONFINED REGION,**
Cambridge Univ. (England). Dept. of Applied Mathematics.
W. D. Baines, and J. S. Turner.
Journal of Fluid Mechanics, Vol 37, Part 1, p 51-80, (1969). 13 ref, 11 fig.

Descriptors: *Buoyance, *Turbulence, Convection.
Identifiers: Entrainment.

This paper considers the effect of continuous convection from small sources of buoyancy on the properties of the environment when the region of interest is bounded. The main assumptions are that the entrainment into the turbulent buoyant region is at a rate proportional to the local mean upward velocity, and that the buoyant elements spread out at the top of the region and become part of the non-turbulent environment at that level. A time-dependent solution is sought which takes into account the possible modification of the environment by the buoyant elements with subsequent effects on the plume. Asymptotic solutions, valid at large times, are obtained from the cases of plumes from point and line sources and also periodically released thermals. The analysis is carried out in detail for the point source in an environment of constant cross-section. Laboratory experiments have beem conducted for this case, and these verify the major predictions of the theory. It is then shown how the method can be extended to include more realistic starting conditions for the convection, and a general shape of bounded environment. Finally, the model is applied quantitatively to a variety of problems in engineering, the atmosphere and the ocean, and the limitations on its use are discussed. (Guerrero-Vanderbilt)
W70-01390

**RIP CURRENTS: 1. THEORETICAL INVESTIGATIONS,**
Liverpool Univ. (England). Tidal Inst.
For primary bibliographic entry see Field 02E.
W70-01431

## 8C. Hydraulic Machinery

**AUTOMATION OF SURFACE IRRIGATION WITH FLUIDIC DIVERTERS,**
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W70-01482

**EVALUATION OF ALL POTENTIAL SOURCES OF ENERGY FOR DESALTING,**
Ebasco Services, Inc., New York.
F. L. C. Reichle.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 1, 604-19, (1967). 9 fig. Paper No SWD/121.
Identifiers: *Dual-purpose plant economics, *Economic evaluations, *Energy sources, *Nuclear desalination, Base-load, Distillation processes, Fossil fuels, Freeze processes, Nuclear energy sources, Osmosis, Peaking power.

Minor sources of energy (solar, geothermal, waste heat, and hydro) may serve best in a few special situations where fresh water demand is small and the source of energy available near the point of need. Major sources of energy (gas, oil, coal, and nuclear) may be optimum, depending on the process used and the salinity of water to be converted. The lowest cost steam or electric energy for desalting can usually be obtained by integrating the energy requirements with an established electric utility system. There is potential for future development in use of off-peak electric power for desalting brackish water by electrodialysis or for such processes as reverse osmosis, freezing, and vapor compression which require relatively small amounts of mechanical energy for desalting either brackish or seawater compared to the large amounts of thermal energy required for distribution processes.
W70-01522

**GAS TURBINES PROVE EFFECTIVE FOR DESALINATION,**
Stal-Laval Turbine Co., Finspang, Sweden.
N. O. Lier.
Power 112 (11), 79-81 (1968). 7 fig.
Identifiers: *Gas turbines, Energy sources, Multistage flash distillation, Vapor compression evaporation, Vertical tube evaporators, Water costs estimate.

A brief comment on the possible use of a 50-MW industrial gas turbine generator as a prime mover and MSF heat source. Normal performance of such a turbine is 47.8-MW output and 193-MBTU/HR available heat in the exhaust gas at 265 deg F. Available heat in the intercooler is 135 MBTU/HR. With this heat, the gas turbine plus straight MSF will give 41.5 MW of saleable power and 7.0 MGD of fresh water. By adding a vapor compressor and two vertical tube evaporators, the system can produce 20.0 MW of saleable power and 19.0 MGD of water. Various combinations of these are possible to provide a wide range of water/power ratios. Assuming 25 cents/MBTU fossil fuel and 6 MIL/KWH sale of power, a gas turbine and MSF plant could produce water for 26 cents/1000 gal, while water from a steam turbine with MSF would result in 41.5 cents/1000 gal water. If we assume 3.5 cents/MBTU fuel and 6 MIL power, the gas turbine with MSF results in a profit of 19.5 cents/1000 gal (a cost of -19.5) and the steam turbine and MSF would have a profit of 1.5 cents/1000 gal. A 400-MW (saleable) nuclear plant producing 72 MGD (selling 6 mil power) would have a water cost of 34.5 cents/1000 gal.
W70-01523

**FRESH WATER FROM NUCLEAR POWER WITH THE AGR AND SGHWR,**
United Kingdom Atomic Energy Authority, Risley (England).
G. R. Bainbridge.
Presented at IAEA Regional Survey Course on Problems and Prospects of Nuclear Power Applications in Developing Countries, Santiago, Chile, Dec 4-7, 1967. 13 p, 11 fig. Report No TRG 1691 (R).
Identifiers: *Dual-purpose plant, *Nuclear energy sources, Energy sources, Parametric studies, Water costs estimate, 0-500 MW (E) reactors, 500 plus MW (E) reactors, 51-250 MGD plant.

Typical parameters were developed for two dual-purpose systems with a gas-cooled reactor, the AGR, or a steam generating heavy water moderated (and light water cooled) reactor, the SGHWR. The AGR parametric design is for 400 MWE net electrical output and 67.5 MGD of fresh water, while the SGHWR design is for 20C MWE and 94.5 MGD. There is scope for varying the proportions of electricity and water products to suit the market. The AGR design is capable of 42% station efficiency if used mainly as an electricity producer. Because of this (the UK has adequate natural water resources at present), it is being built in large reactor-turbine unit sizes of 625 MWE at Dungeness, Hinkley Point, and Hunterston B stations with two reactor-turbine units at each site. Other similar units are planned to provide at least 3000 MWE of AGRS in a total nuclear capacity of 13,000 MWE of gas-cooled reactor stations by 1975. The SGHWR design would give a station efficiency around 33% as an electricity producer. An SGHWR power station in final stages of development (Dec. 1967) at Winfrith Heath will make possible production of either 400 MWE or 200 MWE plus 94.5 MGD of fresh water. Conclusions are that for extrapolating to very large outputs (exceeding 1200 MWE) the AGR is most suitable, while the SGHWR is best for plants below 400 MWE.
W70-01525

**A FUEL CYCLE ECONOMIC ANALYSIS OF OXIDE FUELED POWER AND PROCESS HEAT PWR FOR SEAWATER DESALINATION,**
Oak Ridge National Lab., Tenn.
E. P. Rahe, Jr., J. E. Jones, Jr., and T. T. Robin.
Report ORNL-TM-2046, Jan 1969. 59 p, 7 fig, 20 tab, 17 ref.
Identifiers: *Economic evaluations, *Nuclear fuel cycle costs, AEC sponsored, Fuel costs, Municipal financing, Nuclear fuel processing studies, Pressurized-water reactors, Private financing, Process heat, Thermal-hydraulic design, 3000 plus MW (T) reactors.

Economic studies were conducted to determine minimum equilibrium fuel cycle costs for two oxide fueled PWR concepts. Each reactor is to be used to generate steam for a single-purpose desalination plant. The two reactor concepts studied were a commercial product line power reactor and a lower temperature process heat reactor. Fuel cycle costs were based on economic ground rules believed to be representative for reactors going on-line in 1980-90. The study indicated that, for a publicly owned reactor utilizing a privately owned 75,000 MWT capacity fabrication plant, equilibrium fuel cycle costs of 0.348 MILLS/KWHR (T) and 0.324 MILLS/KWHR (T) could be expected from commercial power and process heat reactors, respectively. These costs are based on an ore cost of $8.00/lb U308, a separative work charge of $26/KG U and a tails of 0.20 Wt.% U-235. For a privately owned reactor using the same fabrication-reprocessing complex, corresponding fuel cycle costs are .385 and .367 MILLS/KWHR (T). If the reactor is publicly owned and the complex is publicly owned with a 15,000 MWTH industry capacity, equilibrium fuel cycle costs are 0.402 and 0.381 MILLS/KWHR (T), respectively.
W70-01527

**THE UNCLAD-METAL BREEDER REACTOR (UMBR) FOR DESALTING OR POWER.**
Oak Ridge National Lab., Tenn.
R. P. Hammond, C. C. Burwell, R. S. Carlsmith, J. G. Delene, and L. C. Fuller.
Report ORNL-4202, Jan 1969. 141 p, 32 fig, 63 ref.
Identifiers: *Economic evaluations, *Feasibility study, *Liquid-metal fast-breeder reactors, AEC sponsored, Breeder reactors, Energy costs, Energy sources, Nuclear design, Nuclear energy sources, Reactor design, 3000 plus MW (T) reactors.

The findings of preliminary investigations of sodium-cooled fast breeder reactors fueled with unclad metal to investigate the possibilities of producing low-cost low-temperature heat suitable for seawater distillation. Fuel materials considered are thorium-based thorium-uranium binary alloys, thorium-based thorium-uranium-plutonium ternary alloys, and uranium-based alloys. Together with the two unclad-metal blanket materials thorium and uranium - used singly or jointly, a number of reactor core combinations is possible. Use of unclad metals as core and blanket materials appears to be technically feasible, based on the incomplete available data. Good breeding gains and doubling times were calculated for all systems considered because of the absence of cladding and other diluents. The characteristics of two reactors fueled with the thorium-based thorium-uranium-plutonium ternary alloy combined with uranium blanket material are presented and the less desirable low-temperature all-uranium-based fuel system and the nearer term high-temperature all-thorium based fuel system are discussed briefly. The reactors considered are one designed primarily for low-temperature.
W70-01528

**ORCENT - A DIGITAL COMPUTER PROGRAM FOR SATURATED AND LOW SUPERHEAT STEAM TURBINE CYCLE ANALYSIS,**
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 07C.
W70-01529

**CONSIDERATIONS AFFECTING STEAM POWER PLANT SITE SELECTION.**
Office of Science and Technology, Washington, D.C.

Report, Dec 1968. 133 p, 110 ref.
Identifiers: *Energy sources, *Power growth surveys, *Site selection criteria, Air pollution, Dual-purpose plant, Exclusion zones, Fossil fuels, Multipurpose plant, Nuclear energy sources, Power requirements, Power transmission systems, Reactor siting, Reviews, Site preparations, Siting surveys.

The purpose of this report is to make available a factual presentation of the public interest considerations affecting generating site selection based on existing information. Many of the siting issues which are only now emerging are apt to become of crucial significance in the future. The report identifies such issues as the prospects and problems of metropolitan siting, undergrounding transmission lines, the need to protect scenic areas and the quality of our air and water and yet meet the nations need for reliable, low-cost power supply. It is clear that a greater effort in research and development and coordinated planning among all concerned interests is needed to achieve optimum solutions. The basic question which the report raises, but does not purport to answer, is what additional planning mechanisms or other actions are needed to identify and utilize in the public interest those prime sites which are best adapted to meeting the conflicting demands of environmental quality control, safety, and reliable economical electric power supply. Both fossil fuels and nuclear energy sources are considered. Dual-purpose as well as power-only plants are covered.
W70-01547

**COST STUDY OF PRODUCT WATER CONVEYANCE AND ELECTRIC POWER TRANSMISSION FOR LARGE NUCLEAR DUAL-PURPOSE PLANTS.**
Parsons Ralph M. Co., Los Angeles, Calif.
For primary bibliographic entry see Field 08A.
W70-01564

**PROGRESS ON THE DESIGN OF MULTIFLASH EVAPORATORS,**
Weir Westgarth Ltd., Glasgow (Scotland).
For primary bibliographic entry see Field 03A.
W70-01565

## 8F. Concrete

**THE DURABILITY OF CEMENT AND CONCRETE IN SEA WATER,**
Standards Institution of Israel, Tel Aviv.
M. Ben-Yair.
Desalination 3, 147-54, 1967, 5 fig, 11 ref. Presented at 2nd European Symp Fresh Water from Sea, Vol 4, Athens, May 1967.
Identifiers: *Concrete construction, *Concretes, *Construction joints (Concrete), Adhesives, Coatings, Fabrication materials, Protective coatings.

Described are results of basic and applied studies performed to clarify the mechanism of sulphate, chloride and magnesium attack on concrete, separately and together, as they occur in seawater, and methods of prevention. Resulting practical precautions suggested for construction of concrete buildings in seawater include (1) a dense and impermeable concrete must be produced under superior control conditions and used without joints or cracks, (2) the most suitable brand of cement and admixture must be selected in each case, e.g., Portland cement A.S.T.M. type I or V, trass, air entrainers, etc., and (3) external protective coatings must be used.
W70-01567

## 8G. Materials

**SEA WATER CORROSION TEST PROGRAM,**
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W70-01397

**RATES OF REACTION OF DISSOLVED OXYGEN WITH SCAVENGERS IN SWEET AND SOUR BRINES,**
Mobil Research and Development Corp., Dallas, Tex.
E. S. Snavely, and F. E. Blount.
Corrosion, Vol 25, No 10, p 397-404, Oct 1969. 8 p, 15 fig, 2 tab, 6 ref.

Descriptors: *Dissolved oxygen, *Corrosion, *Oxidation, *Corrosion control, Chemical reactions, Catalysts, Chemcontrol, Sodium sulfate, Hydrogen sulfide, Sulfides.
Identifiers: *Oxygen scavenging, Oxygen scavengers.

Rates of reaction of dissolved oxygen with hydrogen sulfide were measured in a laboratory apparatus using a polarographic-type instrument for the measurement of oxygen concentrations. Results show that oxidation occurs only at high pH in the absence of catalytic species. The reaction is catalyzed by transition metal ions in the order Ni, Co, Mn, Cu, Fe. In all cases, the reaction rate increases with pH and is at first complex but becomes zero-order with respect to oxygen after a brief introduction period. Some natural waters contain sufficient catalysts that additional amounts are not required for scavenging oxygen with sulfur dioxide or sodium sulfite. Sour waters cannot be scavenged with sulfur dioxide or sodium sulfite because of ineffectiveness of catalysts. (Knapp-USGS)
W70-01435

**PITTING OF TITANIUM ALLOYS IN SALINE WATERS,**
Oak Ridge National Lab., Tenn.
F. A. Posey, and G. G. Bohlmann.

Desalination 3, 269-79, 1967, 10 fig, 40 ref. Presented at 2nd European Symp Fresh Water from Sea, Vol 4, Athens, May 1967.
Identifiers: *Corrosion, *Corrosion tests, *Titanium, Corrosion problems, Evaporated-condenser tubes, Evaporators, Fabrication materials, OSW sponsored, Pitting (Corrosion).

Electrochemical aspects of the corrosion of titanium and a number of its alloys were studied in flowing, high-temperature salt solutions at temperatures up to 220 deg F in a titanium loop facility. Measured polarization curves show that a pitting potential exists at sufficiently high potentials for all the alloys. Increase of temperature greatly affects the temperature are reproducible and quite characteristic of each grade of titanium alloy and show clearly which alloys are superior in tendency towards pitting attack. The results suggest an upper temperature limit of usefulness for many titanium alloys without risk of severe localized attack. Alloys of titanium which contain molybdenum show promise for application in high-temperature saline waters.
W70-01569

**RESEARCH ON CORROSION MECHANISMS IN SALINE WATER, USING REVERSIBLE AND IRREVERSIBLE ELECTRODES,**
Battelle Memorial Inst., Columbus, Ohio.
P. D. Miller, A. B. Tripler, J. J. Ward, F. H. Hanie, and W. K. Boyd.
OSW R and D Progr Rept No 174, Apr 1966. 105 p, 22 fig, 31 tab, 48 ref.
Identifiers: *Corrosion mechanisms, *Thermogalvanic corrosion, Corrosion tests, Electrochemical corrosion, Fabrication materials.

Describes studies on corrosion mechanisms of metals in salt solutions using theoretical and experimental approaches. Investigations included research on corrosion cells driven by thermogalvanic potentials, use of irreversible thermodynamics to construct reaction models to fit experimental data, and use of potentiostatic and polarization techniques to follow electrode reactions. Different configurations of thermogalvanic cells were operated at temperatures ranging to 100 deg C. Sulfate and chloride solutions containing ions with which the electrodes were reversible were studied. Electrodes were made from pure aluminum, copper, iron, nickel, silver, titanium, and zinc. Irreversible thermodynamics helped explain the action of copper, nickel, and zinc thermal cells in sulfate electrolytes containing ions reversible to the electrodes. Calculations aided in predicting temperature coefficients for copper and nickel cells. The zinc system could not be explained completely. Thermogalvanic-cell corrosion was important under numerous conditions. Significantly, dissolved oxygen was not required necessarily for thermogalvanic corrosion to occur. A continuing effort would be necessary to apply these procedures to chloride systems and seawater. Results indicated progress is possible by coupling approaches from polarization studies with those from thermodynamic models and thermogalvanic cells.
W70-01571

## 8H. Rapid Excavation

**BLASTING REGULATIONS.**
For primary bibliographic entry see Field 06E.
W70-01340

# 09. MANPOWER, GRANTS AND FACILITIES

## 9C. Research Facilities

**MARINE RESEARCH, FISCAL YEAR 1968,**
Smithsonian Institution, Washington, D.C. Science Information Exchange.
For primary bibliographic entry see Field 09D.
W70-01261

**ATLANTIC STATES MARINE FISHERIES COMPACT.**
For primary bibliographic entry see Field 06E.
W70-01318

## 9D. Grants, Contracts, and Research Act Allotments

**MARINE RESEARCH, FISCAL YEAR 1968,**
Smithsonian Institution, Washington, D.C. Science Information Exchange.
Monroe E. Freeman.
Nat Counc on Marine Resources and Eng Develop, Executive Office of the President, July 1969. 740 p, 2589 ref, 4 index.

Descriptors: *Bibliographies, *Reviews, *Oceans, *Research facilities, *Projects, Grants, Research equipment, Resource development, Water resources development, Laboratories, Governments, Institutions.
Identifiers: *Marine Research Catalog, Marine resources.

Marine Research--Fiscal Year 1968 is the product of an inventory of Federal and non-Federal organizations with ocean-related research programs and interests. It contains descriptive summaries of 2,589 unclassified projects which were funded, either for the first time or as continuing efforts, during that fiscal year. Associated with these projects, and identified by name and address, are 3,022 investigators; 457 contractors; 25 Federal supporting agencies; and 95 non-Federal sources of support. The projects referenced in the catalog cover basic and applied research on the marine environment and its resources. This environment is defined to comprise the oceans, the estuarine and coastal areas, and the Great Lakes. For purposes of project selection, contributors were requested to interpret the guideline definitions in a broad sense so that pertinent items would be overlooked. In addition to the summaries of the 2,589 projects, the catalog contains the following indexes: Subject Index, Investigator Index, Contractor Index, and Supporting Agency Index. Each project has been indexed to an average of five terms which are arranged in hierarchies indicating relationships between broader and narrower concepts. The index term is followed by the project title, additional keywords used in indexing, and the chapter and subchapter number of the project. (Knapp-USGS)
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# 10. SCIENTIFIC AND TECHNICAL INFORMATION

**THE BIOLOGICAL AND ECOLOGICAL EFFECTS OF ACID MINE DRAINAGE WITH PARTICULAR EMPHASIS TO THE WATERS OF THE APPALACHIAN REGION,**
Washington Univ., Seattle. Coll. of Fisheries.
For primary bibliographic entry see Field 05C.
W70-01463

**SELECTED BIBLIOGRAPHY ON THE CLIMATE OF THE CENTRAL AMERICAN COUNTRIES,**
Environmental Technical Applications Center (Air Force), Washington, D.C.
Vincent J. Creasi.
USAF, Air Weather Service, ETAC Technical Note 69-7, September 1969. 27 p, 69 ref. Available from the Clearinghouse as AD695 482, $3.00 in paper copy, $0.65 in microfiche.

Descriptors: *Bibliography, *Climatology.
Identifiers: Central America.

This bibliography contains 69 climatological references, with annotations, for the Central American Countries. Items are indexed by author and subject matter. All but four of the items were published subsequent to 1959.
W70-01476

**INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE - 3,**
AEC, Oak Ridge National Lab., Tenn.
K. O. Johnson.
National Desalination Information Center, Report ORNL-NDIC-5, UC-80-Reactor Technology, May 1969. 63 p, 200 ref.

Descriptors: *Bibliographies, *Abstracts, *Desalination, Documentation, Distillation, Desalination processes, Desalination plants, Saline water systems.

Abstracts are given for approximately 200 published articles related to the desalination of seawater. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Nuclear Desalination Information Center (NDIC) at the Oak Ridge National Laboratory. The abstracts are grouped in nine categories (and repeated if they fall into more than one category). An author and a keyword index to the articles referenced is provided. The keywords, which identify the content of the articles, were chosen from a thesaurus developed by NDIC.
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| Sources | Accession Numbers | Total |
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| U.S. Geological Survey - Hydrology | W70-01242 -- 01293<br>01295 -- 01300<br>01396 -- 01397<br>01399 -- 01443<br>01445 -- 01457<br>01477 | 119 |
| University of Washington - Water Quality Requirements for Acquatic Organisms | W70-01458 -- 01473 | 16 |
| University of Florida - Eastern U.S. Water Law | W70-01301 -- 01340<br>01585 -- 01641<br>01570, 01574 | 99 |
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| University of Arizona - Arid Lands Water Resources | W70-01484 -- 01486 | 3 |
| **B. Others:** | | |
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| National Agricultural Library | W70-01478 | 1 |
| Office of Saline Water | W70-01480 | 1 |
| Agricultural Research Service | W70-01482, 01481 | 2 |
| Environmental Technical Applications Center | W70-01476 | 1 |
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## Subject Fields

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